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AGRICULTURAL RESEARCH INSTITUTE

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

CONTENTS OF VOL. XVI.

[EIGHTH SERIES.]

NUMBER 91.

Page

I. Descriptions and Records of Bees.—LXVIII. By T. D. A. Cockerell, University of Colorado 1

II. Notes on the British *Machilidæ*, with Descriptions of Two new Species. By Anna J. Reilly, A.R.C.Sc.I., Royal College of Science, Dublin. (Plates I.–V.) 10

III. Notes on the *Tabanidæ* of the Australian Region. By Gertrude Ricardo 16

IV. A new Cestode of the Genus *Zschokkeella*. By H. A. Baylis, B.A. (Plate VI.) 40

V. On some Australian *Cicadidæ*. By W. L. Distant 50

VI. On new Species of *Histeridæ* and Notices of others. By G. Lewis, F.L.S. 54

VII. Notes on the Asiatic Bamboo-Rats (*Rhizomys*, etc.). By Oldfield Thomas.. 56

VIII. On Bats of the Genus *Promops*. By Oldfield Thomas.. 61

IX. Descriptions of Two new Lizards from Australia. By G. A. Boulenger, F.R.S. 64

X. On the African Shrews belonging to the Genus *Crocidura*.—III. By Guy Dollman 66

XI. On the Entomostraca of the Albert Nyanza. By William A. Cunnington, M.A., Ph.D. 80

XII. Descriptions of a new *Modiola* from Ceylon and of a new *Tellina* from New Caledonia. By H. B. Preston, F.Z.S. 84

NUMBER 92.

Page

XIII. A Trematode from *Protopterus*. By H. A. Baylis, B.A... 85

XIV. Descriptions and Records of Bees.—LXIX. By T. D. A. Cockerell, University of Colorado 96

XV. A new Agrionine Dragonfly from Northern Australia. By Herbert Campion (Imperial Bureau of Entomology, London).... 105

XVI. On a new Flat-fish of the Genus *Arnoglossus* from the Black Sea. By Peter Schmidt, Curator of the Ichthyological Department of the Zoological Museum of the Imperial Academy of Sciences in Petrograd.. 108

XVII. Note on an Interesting Abnormality in the Mandibular Arch of *Chimæra monstrosa*, L. By Walter E. Collinge, M.Sc., F.L.S., &c., Research Fellow of the University of St. Andrews, The Gatty Marine Laboratory, St. Andrews 110

XVIII On the Species of the Mascarene Viverrid *Galidictis*, with the Description of a new Genus and a Note on "*Galidia elegans*." By R. I. Pocock, F.R.S., Superintendent of the Zoological Society's Gardens. (Plate VII.) 113

XIX. On the African Shrews belonging to the Genus *Crocidura*. —IV. By Guy Dollman 124

XX. New African Rodents and Insectivores, mostly collected by Dr. C. Christy for the Congo Museum. By Oldfield Thomas .. 140

NUMBER 93.

XXI. On some of the External Characters of the Palm-Civet (*Hemigalus derbyanus*, Gray) and its Allies. By R. I. Pocock, F.R.S., Superintendent of the Zoological Society's Gardens. (Plate VIII.) 153

XXII. Some Observations on the Isopod *Idotea hectica* (Pallas). By Walter E. Collinge, M.Sc., F.L.S., F.E.S., Research Fellow of the University of St. Andrews, the Gatty Marine Laboratory, St. Andrews. (Plate IX.) 162

XXIII. Descriptions of new Species of Mollusca from various Localities. By G. B. Sowerby, F.L.S. (Plate X.) 164

XXIV. New Species of Indo-Malayan Lepidoptera. By Colonel C. Swinhoe, M.A., F.L.S. 170

XXV. Descriptions of new Species of Lepidoptera from Africa and the East. By G. T. Bethune-Baker, F.L.S., F.Z.S......... 186

Page

XXVI. On *Elporia*, a new Genus of Blepharocerid Flies from South Africa. By F. W. Edwards, B.A., F.E.S. 203

XXVII. The *Xylophilidæ* of Ceylon. By G. C. Champion, F.Z.S. 215

XXVIII. On the Species of *Lucifer* and their Distribution. By L. A. Borradaile, M.A., Lecturer in Zoology in the University of Cambridge; Fellow, Dean, and Lecturer of Selwyn College 226

XXIX. Note on the Nomenclature of certain Species of Ruteline Coleoptera. By Gilbert J. Arrow 231

New Book:—An Index to the Museum Boltenianum 232

NUMBER 94.

XXX. Observations on the Cape *Cephalodiscus* (*C. gilchristi*, Ridewood) and some of its Early Stages. By J. D. F. Gilchrist, M.A., Ph.D., D.Sc. With an Appendix by Sidney F. Harmer, Sc.D., F.R.S. (Plate XI.) 233

XXXI. On the Lepidoptera collected in 1913–1914 by Herr Geyr von Schweppenburg on a Journey to the Hoggar Mountains. By Lord Rothschild, F.R.S., Ph.D.—Part I. 247

XXXII. Notes on the *Tabanidæ* of the Australian Region. By Gertrude Ricardo 259

XXXIII. Notes on Fossorial Hymenoptera.—XVII. On new Ethiopian Species. By Rowland E. Turner, F.Z.S., F.E.S. 286

XXXIV. On the Pacific Species of *Hippoglossoides*. By Peter Schmidt, Curator of the Ichthyological Department of the Zoological Museum of the Imperial Academy of Sciences in Petrograd .. 299

XXXV. A Special Genus for the Himalayan Bat known as *Murina grisea*. By Oldfield Thomas 309

XXXVI. A new Genus of Phyllostome Bats and a new *Rhipidomys* from Ecuador. By Oldfield Thomas 310

XXXVII. Further Notes on Asiatic Bamboo-Rats. By Oldfield Thomas 313

XXXVIII. Upon a Remarkable new Genus of Lamellicorn Beetles from Borneo. By Gilbert J. Arrow 317

XXXIX. Upon the Beetles of the Melolonthid Genus *Rhopæa* found in the Fiji Islands. By Gilbert J. Arrow 319

Page

XL. Rhynchotal Notes.—LVI. By W. L. DISTANT 322

XLI. On some Enigmatical Names in Conchology and Pycnogonology. By the Rev. THOMAS R. R. STEBBING, M.A., F.R.S. .. 328

XLII. Notes and Synonymy of Hymenoptera in the Collection of the British Museum. By GEOFFREY MEADE-WALDO, M.A., CLAUDE MORLEY, F.Z.S., and R. E. TURNER, F.Z.S.—II. 331

XLIII. On some of the External Characters of the Genus *Linsang*, with Notes upon the Genera *Poiana* and *Eupleres*. By R. I. POCOCK, F.R.S., Superintendent of the Zoological Society's Gardens. (Plates XII. & XIII.) 341

XLIV. On some External Characters of *Galidia*, *Galidictis*, and related Genera. By R. I. POCOCK, F.R.S., Superintendent of the Zoological Society's Gardens. (Plates XIV. & XV.) 351

XLV. On the African Shrews belonging to the Genus *Crocidura*. —V. By GUY DOLLMAN 357

NUMBER 95.

XLVI. Some Protozoa from Fishes occurring in the Vicinity of Cullercoats, Northumberland. By THOMAS BENTHAM, B.Sc. Oxon., M.Sc. Dunelm., Demonstrator in Zoology, University of Durham. (Plates XVI. & XVII.) 381

XLVII. On the Lepidoptera collected in 1913-1914 by Herr Geyr von Schweppenburg on a Journey to the Hoggar Mountains (Sahara). By LORD ROTHSCHILD, F.R.S., Ph.D.—Part II. 392

XLVIII. Description of a new Tree-frog of the Genus *Hyla* discovered by Mr. A. E. Pratt in the Arfak Mountains, Dutch New Guinea. By G. A. BOULENGER, F.R.S. (Plate XVIII.) 402

XLIX. New Genera and Species of Mammals from the Miocene Deposits of Baluchistan.—Preliminary Notice. By C. FORSTER-COOPER, M.A., Superintendent, University Museum of Zoology, Cambridge 404

L. Descriptions of Three new Neotropical Butterflies. By EMILY M. BOWDLER SHARPE 411

LI. Two new Species of *Monhystera* (Nematodes) inhabiting the Gill-chambers of Land-crabs. By H. A. BAYLIS, B.A. 414

Page

LII. A Note on the Parasphenoid of a Palæoniscoid. By HENRY DAY, M.Sc., Geological Department, The University, Manchester .. 421

LIII. Notes on Fossorial Hymenoptera.—XVIII. On the Australian Species of *Bembex*. By ROWLAND E. TURNER, F.Z.S., F.E.S. . 431

LIV. A new Bat from Northern Nigeria. By OLDFIELD THOMAS. 447

NUMBER 96.

LV. A new African Earthworm, collected by Dr. C. Christy for the Congo Museum; with a Note on its Spermathecæ and Spermatophores. By H. A. BAYLIS, B.A. 449

LVI. List of Mammals (exclusive of Ungulata) collected on the Upper Congo by Dr. Christy for the Congo Museum, Tervueren. By OLDFIELD THOMAS, F.R.S. 465

LVII. Descriptions and Records of Bees.—LXX. By T. D. A. COCKERELL, University of Colorado 482

LVIII. Rhynchotal Notes.—LVII. By W. L. DISTANT 489

LIX. On the Extension of the Range of the American Slipper-Limpet on the East Coast of England. By G. C. ROBSON, B.A. .. 496

LX. On the Periproctal Plates of *Discoidea cylindrica* (Lamarck). By FREDERICK J. NORTH, B.Sc., F.G.S., Assistant Keeper, Geological Department, National Museum of Wales 499

LXI. Three new Species of the Dipterous Genus *Olbiogaster*, O.-S., in the British Museum Collection. By F. W. EDWARDS, B.A., F.E.S. 502

LXII. The Name of the Species described by Gray as *Galidictis vittatus*. By R. I. POCOCK, F.R.S. 505

LXIII. On the African Shrews belonging to the Genus *Crocidura*.—VI. By GUY DOLLMAN 506

Proceedings of the Geological Society 515

Index 516

PLATES IN VOL. XVI.

PLATE I. II. III. IV. V. Structural details of Petrobius voctensis and Petromachilis longicornis.
VI. Zschokkeella muricola.
VII. Galidictis eximius, G. ornatus, Mungotictis vittatus, and M. substriatus.
VIII. Hemigalus derbyanus.
IX. Idotea hectica (*Pallas*).
X. New Mollusca from various localities.
XI. Larva of Cephalodiscus gilchristi.
XII. Poiana richardsoni and Linsang linsang.
XIII. Eupleres goudoti, Fossa fossa, and F. majori.
XIV. Galidia elegans and Galidictis eximius.
XV. Mungotictis substriatus and Galidictis eximius.
XVI. XVII. Some Protozoa from Fishes.
XVIII. Hyla angiana.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[EIGHTH SERIES.]

> " . . . per litora spargite muscum,
> Naiades, et circum vitreos considite fontes:
> Pollice virgineo teneros hic carpite flores.
> Floribus et pictum divæ replete canistrum.
> At vos, o Nymphæ Craterides, ite sub undas,
> Ite, recurvato variata corallia trunco
> Vellite muscosis e rupibus et mihi conchas
> Ferte, Deæ pelagi, et pingui conchylia succo."
>
> *N. Parthenii Giannettasii*, Ecl. 1.

No. 91. JULY 1915.

I.—*Descriptions and Records of Bees.*—LXVIII.

By T. D. A. Cockerell, University of Colorado.

Prosopis palavanica, sp. n.

♂.—Length about 6 mm.

Robust, black, head and thorax densely punctured, abdomen shining; head broad, clypeus high; large triangular patch on clypeus, confluent with an apical band, lateral face-marks (but no supraclypeal mark), and narrow stripe on outer side of the short scape all yellow; lateral face-marks filling space between clypeus and eye, abruptly truncate above just below level of antennæ, but sending a narrow band beyond, up along the orbital margin to about level of middle of front; labrum and mandibles black; flagellum stout, submoniliform, very obscure brownish beneath; mesothorax more coarsely punctured than front; tubercles (but not tegulæ) with a yellow spot; area of metathorax coarsely irregularly wrinkled, the sinuses between the wrinkles shining; tegulæ piceous. Wings greyish hyaline, stigma and nervures piceous; first r. n. meeting first t.-c.; second s.m. much broader than high (as in *P. tagala*, Ashm.). Legs black, anterior tibiæ broadly yellow in front, anterior tarsi obscurely reddish, the other tarsi dark reddish apically. Abdomen shaped like that of a female, microscopically reticulate, and with fine piliferous punctures, so that the surface does not appear smooth; stipites with long beautifully plumose hairs.

Hab. P. Princesa, Palawan (Baker coll. 3853).

Prosopis taclobana, sp. n.

♂.—Length about 4·5 mm.

Rather slender, black; head and thorax dull, extremely densely and finely punctured; abdomen also very finely punctured, but somewhat shining; head large and round, the face greatly narrowed below; clypeus and lateral face-marks (abruptly truncate just below antennæ) chrome-yellow, but supraclypeal area black; mandibles and labrum marked with yellow; scape short, broadly yellow in front; flagellum extremely long and slender, not moniliform, obscure brownish beneath; a broadly interrupted band on prothorax, tubercles, and large spot on tegulæ yellow; basal part of metathorax divided by ridges into four large areas, which are themselves finely reticulate, apically between the two midmost areas is a large pit. Wings greyish hyaline, stigma sepia; first r. n. meeting first t.-c., second s.m. about as broad as high. Tibiæ and tarsi rich yellow, anterior tibiæ with a black mark behind, middle and hind tibiæ each with a broad subapical black ring; stipites each with a pair of long stiff yellow bristles, which are hyaline and briefly fimbriate at the end.

Hab. Tacloban, Leyte, Philippine Is. (Baker coll. 3665).

The following table separates the Philippine species of *Prosopis*. These are all distinct from those described by Friese from Java:—

	Second s.m. about as broad as high; clypeus of male entirely yellow	*taclobana*, Ckll.
	Second s.m. much broader (longer) than high ...	1.
1.	Clypeus all black; lateral face-marks triangular, broadly truncate above; female	*tagala*, Ashm.
	Clypeus with a light spot or patch	2.
2.	Area of metathorax coarsely wrinkled	*palavanica*, Ckll.
	Area of metathorax rugulose, without strong sculpture	*luzonica*, Ckll.

Trigona palavanica, sp. n.

Worker.—Length about 5 mm.

Black, without light markings on head, thorax, or legs, but [illegible]t dorsal abdominal segment very bright orange-ferruginous, and ventral surface of abdomen apricot-colour; head broad, face grey-pruinose; flagellum obscurely brown beneath, and insertion of antennæ light reddish; mesothorax dull, bordered anteriorly and posteriorly by a band of pale greyish-ochreous tomentum; pleura and sides of metathorax grey-pruinose. Wings brownish, stigma and nervures dark brown. Hind tibiæ and basitarsi greatly expanded; hair on inner side of hind basitarsi dark fuscous, but shining brilliant coppery red when seen from above. Apical segment of abdomen obscure reddish.

Hab. P. Princesa, Palawan (Baker coll. 3839).

Related to *T. ventralis*, Sm., but easily known by the bright red base of abdomen. It is quite distinct from the numerous Bornean species tabulated by Cameron.

Mesotrichia philippinensis, Sm., var. *chlorina*, v. n.

♀.—Length fully 21 mm., anterior wing 18 mm.

Wings golden green; thorax posteriorly yellow right across; cheeks with a good deal of white hair.

Hab. Los Baños, Luzon, Philippine Is. (*Baker*, 2).

This is much too large for the var. *bilineata*, Friese. Typical *M. philippinensis* ♀ was sent from Malinao, Tayabas (*Baker*, 3661); this has the iridescence of wings rosy purple and the thorax posteriorly yellow only at sides.

Xylocopa mimetica, sp. n.

♂.—Length 24 mm., anterior wing 22, width of abdomen 10.

Black, with all the hair, including that on legs, black; mandibles bidentate; labrum coarsely, confluently punctured, with a basal smooth shining band, which sends a linear process downward in the middle; clypeus coarsely, confluently punctured, with a slight median keel; band on upper border of clypeus, broader contiguous supraclypeal band, lateral face-marks (filling space between clypeus and eye, and broadly truncate above some distance above level of antennæ), and spot on each side of anterior ocellus all ivory-colour; antennæ black, flagellum (except first joint, which is shining black) brownish beneath, the segments except the last each with an obscure red spot; third antennal joint about as long as next three together. Wings very dark fuscous, anterior wings shining bluish green, violet in region of marginal cell, yellowish green in subapical field, and pinkish at apex. Abdomen strongly but not densely punctured.

Hab. P. Princesa, Palawan (Baker coll. 3834). From the same locality comes a female *Mesotrichia amauroptera* (*Xylocopa amauroptera*, Pérez), Baker coll. 3835.

I understand that the bees from other islands than Luzon were not collected by Professor Baker personally, but by a collector in his employ.

X. mimetica is superficially exactly like *M. amauroptera*, though there are important structural differences, not only in the thorax, but also in variation—*e. g.*, the lower section of the basal nervure is much longer than in *amauroptera.*

X. mimetica is closely allied to *X. dissimilis*, Lep., but without pale hair on thorax. The abdomen has none of the greenish colour of *X. fallax*, Maidl, while the wings have not the brilliant green tints of *X. auripennis*, Lep. *X. pictipennis*, Sm., from Java, is related, but much larger, with more brilliantly coloured wings.

Anthophora zonata stantoni, Cockerell.

Mt. Makiling, Luzon (*Baker*, 3815); Dapitan, Mindanao (Baker coll. 3844).

Two males, quite alike. The male shows that this form is very close to *A. korotonensis*, Ckll., from Formosa, having the same general characters, including the structure of ventral segments of abdomen. The abdominal bands are a beautiful pearly green.

Nomada mindanaonis, Cockerell.

Two females from P. Princesa, Palawan (Baker coll. 3880). One is smaller than the other and has only two submarginal cells, the second t.-c. being absent; it is apparently only a variation. The larger specimen is larger than the original type of the species.

Halictus waterhousei, sp. n.

♀ (type).—Length 10 mm., expanse 19·5.

Black, including legs and antennæ; head rather narrow, cheeks moderate; front and vertex with thin fulvous hair; clypeus strongly and more or less confluently punctured, but shining between the punctures; front dull and rough; thorax above, and at least on upper part of sides, clothed with fulvous hair (matted in the type, which has been in some liquid); mesothorax dull and rough, with dense small punctures; pleura striate; area of metathorax large, feebly wrinkled; tegulæ rufo-testaceous. Wings strongly greyish, slightly orange-tinted basally, anterior wings suffusedly blackened at apex; stigma ferruginous; first r.n. joining second s.m. near end; outer r.n. and t.-c. slender; third s.m. much broader than second, third t.-c. with a single curve; femora with pale hair, but that on tibiæ and tarsi nearly all black or dark fuscous, more or less whitish on inner side of hind basitarsi; hind spur with only very minute short comb-like teeth. Abdomen shining black, with black hair, no bands or patches; hair on venter whitish, except apically; first dorsal segment with scattered minute punctures, these in the submarginal region numerous though extremely small; second segment with minute punctures very sparse on disc.

♂.—Length 10 mm., expanse 18.

Like the female, but more slender; clypeus with a very large cream-coloured transverse patch, obtusely angulate in middle above; antennæ very long, entirely black, flagellum strongly crenulate beneath; area of metathorax much more coarsely sculptured, being thrown into coarse irregular wrinkles; first and second abdominal segments slightly glaucous (except depressed hind margins), finely and rather closely punctured all over.

The differences in sculpture of metathorax and abdomen in the two sexes are surprising, but they seem to belong to the same species.

Hab. Woodford, New South Wales, Jan. 1909 (*G. A. Waterhouse*). Brit. Museum. The female taken Jan. 24, the male Jan. 31.

Allied to *H. musicus*, Ckll., but entirely distinct by the colour of the tegulæ, the arrangement of hair on thorax, and sculpture of mesothorax and abdomen. The clypeus of *H. musicus* is more shining and less densely punctured.

Halictus pavonellus, sp. n.

♀.—Length about 4·25 mm.

Head small, nearly circular, dull dark blue-green, the clypeus mainly black; head and thorax with thin white hair; antennæ black, the flagellum ferruginous beneath toward apex; mesothorax and scutellum dull, rich deep blue, rest of thorax very obscure blue-green, posterior truncation (which is well defined) bluer; area of metathorax with fine longitudinal ridges and little cross ones between; tegulæ clear reddish, dark at base. Wings faintly dusky;

stigma short, rufo-piceous, nervures redder; outer t.-c. and r.n. almost wholly invisible, but the shadowy third s.m. very high and short. Femora black; the knees, tibiæ, and tarsi ferruginous, middle and hind tibiæ suffused with dusky. Abdomen dark, with a strong tinge of blue-green or bluish, hind margins of segments piceous, first segment shining, the others duller; a curled scopa of white hair on abdominal venter.

Microscopical characters:—Front lineolate and punctured; mesothorax minutely tessellate and with very minute punctures; tegulæ impunctate; first abdominal segment with excessively minute punctures, the other segments feebly transversely striolate and with very minute piliferous punctures; hind spur with two long blunt teeth.

Hab. Bribie Island, Queensland, Nov. 2, 1913 (*H. Hacker*). Queensland Mus 114.

The following table separates it from its nearest relatives:—

	Stigma pale testaceous	*floralis*, Sm.
	Stigma dark fuscous or rufo-fuscous	1.
1.	Apical part of stigma abbreviated; mesothorax dark blue: smaller species	*pavonellus*, Ckll.
	Stigma normal; mesothorax dark green: larger species	*dampieri*, Ckll.

Halictus callaspis, sp. n.

♀.—Length about 6·5 mm.

Head and thorax with loose white hair, abundant at sides of thorax; head broad, clypeus prominent, its basal margin little above level of lower ends of eyes; head olive-green, tinged with brassy about bases of antennæ and on supraclypeal area; clypeus shining peacock-green, its upper margin very narrowly purple; antennæ black, flagellum obscurely reddish beneath toward apex; mesothorax yellowish green, much brighter than head, granular but somewhat glistening, not distinctly punctured; scutellum more shining, peacock-green; rest of thorax rather obscure olive-green; area of metathorax very finely irregularly lineolate; posterior truncation not sharply defined; tegulæ reddish. Wings hyaline, stigma amber-colour; outer r.n. and t.-c. almost obsolete; first r.n. meeting second t.-c. Femora dark olive-green; knees more or less reddish; tibiæ and basitarsi piceous, with much white hair; small joints of tarsi dull ferruginous. Abdomen shining olive-green, without conspicuous punctures, apical segments with thin white hair, but no hair-bands or patches; venter of abdomen with a white pollen-collecting scopa.

Microscopical characters:—Clypeus with sparse strong punctures; front strongly lineolate; mesothorax minutely tessellate, with sparse very feeble punctures; abdomen finely transversely lineolate, with only piliferous punctures; hind spur with a large blunt tooth and a small rounded one.

Hab. Bribie Island, Queensland, Nov. 2, 1913 (*H. Hacker*). Queensland Mus. 109.

The following table separates it from its allies:—

	Stigma amber-colour; area of metathorax very finely lineolate.	*callaspis*, Ckll.
	Stigma dark fuscous or rufo-fuscous; area of metathorax much more coarsely sculptured	1.
1.	Mesothorax with conspicuous and numerous punctures	*flindersi*, Ckll.
	Mesothorax with sparse very minute punctures	*behri transvolens*, Ckll.
	Mesothorax with transverse plicæ and no readily noticeable punctures ..	2.
2.	Smaller: mesothorax yellowish green.	*caloundrensis*, Ckll.
	Larger: mesothorax bluish green	*caloundrensis leucurus* (Ckll.).

The last was described as a variety of *H. flindersi*, but it is in reality a variety of *H. caloundrensis*, having the same type of mesothorax.

Halictus rufotinctus, sp. n.

♀.—Length 4–4·25 mm.

Robust, with short broad-oval abdomen; head black, with short dull white hair; flagellum dull ferruginous beneath; mesothorax and scutellum olivo-green, the mesothorax with a slight coppery shade on each side mesad of parapsidal groove (in var. *a*, the mesothorax is dark blue-green); rest of thorax black, the sides with rather copious white hair; mesothorax dullish, finely and closely punctured, disc of scutellum shining; area of metathorax large, irregularly cancellate; tegulæ castaneous, black at base. Wings hyaline; stigma pale amber-colour; outer r. n. and t.-c. so faint as to be almost obsolete; first r. n. reaching apical corner of second s.m. Legs black, with pale hair. Abdomen broad, dullish, first segment shining; first segment black, second dark castaneous, with a black band across the middle, third and fourth dark castaneous, with a more or less evident transverse black band; fifth black, with caudal rima rufo-fulvous; hair of abdomen scanty, no bands or patches.

Microscopical characters:—Face with fine plumose white hairs; front minutely sculptured, with very fine punctures in grooves; disc of mesothorax lineolate and finely punctured; basal part of tegulæ with very fine piliferous punctures; first abdominal segment and basal half of second very finely punctured; apical half of second segment minutely transversely lineolate; hind spur with two large blunt teeth, and a low wave-like one beyond.

Hab. Brisbane, Queensland, Oct. 8, 1912 (*H. Hacker*). Queensl. Mus. 129.

Related to *H. inclinans*, Sm., but quite distinct by colour of abdomen and legs.

Halictus subinclinans, sp. n.

♀.—Length 6·25 mm.

Head broad, black; mandibles dark reddish in middle; supraclypeal area and base of clypeus olive-green; flagellum short and thick, bright ferruginous beneath except at base; clypeus short, front dull and granular; mesothorax dark green, dullish, finely but distinctly punctured; scutellum rather more shining and more brassy; rest of thorax black, pleura and sides of metathorax with dull white hair; area of metathorax large, poorly defined, rugulose, with very short plicæ at sides basally; posterior truncation poorly defined; tegulæ rufo-fuscous. Wings hyaline, stigma amber-colour; outer r. n. and t.-c. greatly weakened, first r. n. reaching base of third s.m. Legs black, the tarsi obscurely reddish. Abdomen broad, shining brownish black, very finely punctured, hind margins of segments slightly reddish; apical half with fine pale hair, but no bands or distinct patches.

Microscopical characters:—Supraclypeal area and base of clypeus with tessellate sculpture and fine scattered punctures; apical part of clypeus also tessellate and punctate, but the surface more or less undulate and the punctures larger and fewer; front with the dense punctures tending to run into grooves; mesothorax tessellate between the punctures; second abdominal segment sculptured like the apical two-thirds of first, basal part of first with much sparser punctures; tegulæ impunctate; hind spur curved, with a single large broadly rounded (subtruncate) tooth and a low broad (wave-like) one beyond.

Hab. Launceston, Tasmania, Feb. 15, 1914 (*F. M. Littler*, 2568).

Allied to *H. inclinans*, Sm., but easily distinguished by the greater size, darker tegulæ, and dark legs. It appears to be the Tasmanian representative of *H. inclinans*.

Halictus (*Chloralictus*) *busckiellus*, sp. n.

♀.—Length about 4 mm.

Head and thorax dark green, abdomen black, hind margins of segments obscure reddish; mandibles dark castaneous, black at base; flagellum dull ferruginous beneath; tegulæ rufo-fuscous. Wings rather short, greyish hyaline, stigma dusky reddish. Legs black, tarsi reddish apically. Hair white, rather abundant on cheeks, pleura, and apical segments of abdomen. Head broad, its width 1·3 mm.; clypeus not much produced, shining, sparsely punctured, the punctures on basal half smaller and closer than those on apical, and nearly all emitting hairs; supraclypeal area minutely tessellate, with extremely minute scattered piliferous punctures; front very delicately roughened, with a microscopically reticulate sculpture, the middle portion minutely punctured, the intervals between the punctures crossed by lines; mesothorax dullish, minutely tessellate, with scattered extremely minute punctures; tegulæ impunctate; area of metathorax with a fine file-like striation, the striæ very oblique at sides; abdomen shining, minutely transversely lineolate; first r. n. meeting second t.-c.; second s.m. small, third s.m. large and broad, nearly or quite twice as broad above as second; hind spur with about three long teeth.

Hab. Island of S. Domingo, West Indies, 7. 8. 05 (*Aug. Busck*). U.S. National Museum.

Allied to the Cuban *H. parvus* (Cresson), but the face is only thinly hairy, the tegulæ are darker, sculpture of front is different, mesothorax is duller, and scutellum is not polished. *H. plumbeus*, Ashm., is readily separated from *H. busckiellus* by the narrower face and more strongly and closely punctured front; *H. jamaicæ*, Ellis, is separated by the lighter tegulæ, red knees, and mainly red tarsi, as well as the closely punctured sides of front.

II.—*Notes on the British* Machilidæ, *with Descriptions of Two new Species.* By ANNA J. REILLY, A.R.C.Sc.I., Royal College of Science, Dublin.

[Plates I.-V.]

IN Lubbock's 'Monograph of the Collembola and Thysanura' (1873) there are descriptions of *Machilis polypoda* and *Machilis maritima*, only two species of the Machilidæ being recognized in Great Britain at that period. Silvestri (1904) justified the establishment of the genus *Petrobius* by Leach (1809) for *M. maritima* by showing that *Machilis* has paired processes (gonapophyses or paramera) on both the eighth and ninth abdominal segments in the male, while *Petrobius* has these structures on the ninth segment only. Verhoeff (1910) established the genus *Halomachilis*, characterizing it by the following structural details:—apex of the mandible untoothed, feelers without scales except on the two basal segments, tip of labial palp having many flattened sensory spines. These details prove this genus to be identical with *Petrobius*.

Many species of *Petrobius* have since been recorded; Oudemans (1886) described a Dutch insect which he called *Machilis maritima*, and which agrees in many respects with the new species *Petrobius vectensis* described in this paper. I am indebted to Mr. R. S. Bagnall and Mr. E. Popple, Berkhamsted, for these specimens of *P. vectensis*; they were collected near Shanklin, Isle of Wight. I am also indebted to Mr. P. A. Buxton, Trinity College, Cambridge, for some specimens of this species which were collected by him at St. Helen's, Isle of Wight.

The second species described falls into a new genus of the Machilidæ—*Petromachilis*. The specimens were collected in August 1911 at Wasdale Head, Cumberland, by Mr. J. W. Shoebotham, who sent them to Prof. G. H. Carpenter, Royal College of Science, Dublin, for description. Prof. Carpenter kindly asked me to describe these and the Isle of Wight insects mentioned above, giving me some help and instruction in methods of procedure.

The genus *Petromachilis* is intermediate between *Machilis* and *Petrobius*, agreeing with *Machilis* in having paired processes on both the eighth and ninth abdominal segments in the male, and with *Petrobius* in having no scales on the antennæ except on the two basal segments, while it is intermediate between the two genera with regard to the mandible.

It may be distinguished from the other British genus of Machilidæ, *Præmachilis*, Grassi, by the presence of two pairs of exsertile vesicles on the second to the fifth abdominal segments inclusive, *Præmachilis* having not more than one pair of vesicles on any abdominal segment.

Genus PETROBIUS, Leach (1809).

Petrobius vectensis, sp. n. (Pls. I. & II.)

Body-length 8 mm. (male). Feelers (incomplete) at least as long as the body; tail-processes (incomplete) also at least as long as the body. Feelers, cerci, and tail-process white-ringed. Paired ocelli dumbbell-shaped, less than a transverse diameter apart (Pl. I. fig. 2). Mandible with blunt apex (Pl. I. figs. 3 & 4 *a*). Maxilla with lacinia slightly shorter than galea (Pl. I. figs. 6 & 6 *a*). Palp having its six elongate segments with proportional lengths 6 : 8 : 10 : 11 : 11 : 10. In the eighth abdominal segment of the male the subcoxæ are produced into prominent rounded lobes (Pl. II. fig. 1). The ninth abdominal segment has the subcoxæ produced into small pointed processes (Pl. II. fig. 2). Gonapophyses not reaching quite to tips of subcoxæ. Penis projecting to about three-fourths length of stylet; stylets with long, acute, apical spines. In the eighth abdominal segment of female the subcoxæ are produced into acute processes projecting to about ⅓ length of stylet. Ovipositor of female nearly as long as the cerci, which are less than half the length of the incomplete tail-process.

Loc. (1) Shanklin, Isle of Wight; collected by Mr. E. Popple, Berkhamsted, May 1913. (2) St. Helen's, Isle of Wight; collected by Mr. P. A. Buxton, Aug. 1912.

This species agrees with *P. brevistylis*, Carpenter (1913), in having the mandible with blunt truncated apex, and contrasts with *P. maritimus*, Leach (1809), the mandible of which is acute. It agrees in many of its characters with the Dutch insect which Oudemans designated *Machilis maritima* and described in his memoir (1886). Prof. G. H. Carpenter, in a paper on the "Irish Species of *Petrobius*" (1913), referred to the latter insect, pointed out that it is certainly not the true *maritimus* of Leach, and suggested *P. oudemansi* as an appropriate name for it. Oudemans, in his drawings, figures the lacinia of the maxilla much longer than the galea; but in *P. vectensis* the lacinia is slightly shorter than the galea, agreeing with *P. brevistylis*, Carpenter, while the penultimate segment of the maxillary palp is not twice as long as the apical (as in *P. oudemansi*), but in the proportion $\frac{1}{11}$. The gonapophyses in the male do not reach the tips of the ninth abdominal subcoxæ, in this respect being similar to those of *P. oudemansi*; but the penis attains to about three-fourths the length of the ninth abdominal stylets. *P. vectensis* agrees with *P. oudemansi* and *P. brevistylis* in having prominent lobes on the subcoxæ of the eighth abdominal segment in the male.

A synopsis of the prominent features of the four species of *Petrobius* mentioned in this paper is given below :—

A. Eighth abdominal segment ♂ with subcoxæ not produced into prominent rounded lobes .... *Petrobius maritimus*, [Leach.

A_1. Eighth abdominal segment ♂ with subcoxæ produced into prominent rounded lobes.

  B. Stylets of ninth abdominal segment ♂ relatively short and thick, with very short blunt apical spines; gonapophyses reaching to tips of subcoxæ. Penis very elongate, projecting beyond the stylets .... *Petrobius brevistylis*, [Carpenter.

  B_1. Stylets of ninth abdominal segment ♂ relatively long and thin, with long acute apical spines; gonapophyses not reaching to tips of subcoxæ.

    C. Subcoxæ of eighth abdominal segment ♀ not produced into long pointed processes. Penis in ♂ attaining only to half the length of the ninth abdominal stylets .... *Petrobius oudemansi*, [Carpenter (=*Machilis maritima*, Oudemans).

    C_1. Subcoxæ of eighth abdominal segment ♀ produced into long pointed processes about $\frac{1}{3}$ length of stylets. Penis in ♂ projecting to about $\frac{3}{4}$ length of stylets. *Petrobius vectensis*, sp. n.

Genus PETROMACHILIS, nov.

The antennæ have scales only on the two basal segments (Pl. III. fig. 1*a*). The apex of the mandible is bluntly truncated and bears on its inner margin two minute blunt teeth (Pl. III. figs. 3 & 4). The galea of the maxilla is jointed towards the base (Pl. III. fig. 6). One pair of exsertile vesicles is present on the first abdominal segment. The abdominal segments 2–5 bear each two pairs of exsertile vesicles (Pl. IV. figs. 2, 3, 4, & 5). The sixth and seventh abdominal segments each bear one pair of exsertile vesicles. The seventh abdominal segment has the subcoxæ produced into rounded lobes, much longer in the female than in the male (Pl. IV. figs. 7 & 7 *a*).

Petromachilis longicornis, sp. n. (Pls. III., IV., & V.)

Length of the body 10 mm. (female). Feelers and tail-process much longer than the body. In segmentation of feelers the segments are arranged in groups of 12–14 (Pl. III. fig. 1 *b*). The ocelli are dumbbell-shaped and about a quarter of a transverse diameter of an eye apart. The median ocellus is semicircular in form, with straight anterior edge (Pl. III. fig. 2). Maxilla with lacinia slightly shorter than galea (Pl. III. figs. 6 & 6 *a*). Palp of maxilla having its six elongate segments with proportional lengths 6:6:6:8·5:7 5;5·5; antepenultimate segment markedly swollen distally (Pl. III. fig. 6). The last two segments of the maxillary palp present a tapering appearance. The abdominal segments 2–5 bear each two pairs of exsertile vesicles (Pl. IV. figs. 2, 3, 4, & 5). In the eighth and ninth abdominal segments of the female the processes of the ovipositor have fifty-two segments, each carrying one strong hair on outer margins, and each segment also bearing a whorl of smaller hairs. Gonapophyses on eighth abdominal segment of the male project from mid-line of subcoxæ to about ¾ length of stylets of that segment. In the ninth abdominal segment of the male the subcoxæ are produced into very small pointed processes; the gonapophyses do not reach the tips of the subcoxæ, stylets long, relatively stout, and with acute apical spines; penis short, only projecting to ⅓ length of stylets (Pl. V. fig. 9 *a*).

Loc. (1) Wasdale Head, Cumberland; collected by Mr. J. W. Shoebotham, Aug. 1911. (2) Caldey Is., Pembrokeshire, South Wales; collected by Mr. P. A. Buxton, June 1914.

In forwarding his specimens, Mr. Shoebotham mentioned that he found them beneath the top stones of a wall around Wasdale Head House, close to the upper end of Wastwater and the foot of Scafell. The locality of Mr. Buxton's specimens (Caldey Island, off South Wales) suggests that this species may be widely distributed in the remoter parts of Great Britain.

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EXPLANATION OF THE PLATES.

Plate I.

Structural details of *Petrobius vectensis*.

Fig. 1. Lateral (right) view of insect, ♀. × 12.

Fig. 2. Diagram showing shapes and positions of compound eyes (*e*), lateral ocelli (*o*), and median ocellus (*mo*). × 30.

Fig. 3. Right mandible of female, hinder aspect. *c*, condyle; *a*, apex; *m*, molar area. × 62.

Fig. 4. Terminal region of same mandible. *a*, apex; *m*, molar area. × 124.

Fig. 5. Left maxillula, hinder aspect. *l*, lacinia; *g*, galea; *p*, palp. × 124.

Fig. 6. Right maxilla of female, hinder aspect. *c*, cardo; *st*, stipes; *l*, lacinia, *g*, galea; *p*, palp. × 62.

Fig. 6 a. Head of lacinia of same maxilla, showing apex (*a*), "brush" (*b*), and acute processes (*c* and *d*). × 280

Fig. 7. Labium of female. *m*, submentum; *l*, mentum; *p*, palp. × 62.

Fig. 7 a. Sensory spines from apex of labium. × 280.

Plate II.

Structural details of *Petrobius vectensis* (continued).

Fig. 1. Eighth abdominal segment, ♂, ventral aspect. *sc*, subcoxa; *st*, stylet; *s*, sternum. × 40.

Fig. 2. Ninth abdominal segment, ♂, ventral aspect. *sc*, subcoxa; *g*, gonapophysis; *p*, penis; *st*, stylet. × 40.

Fig. 3. Fifth abdominal segment, ♂, ventral aspect. *s*, sternum; *sc*, subcoxa; *ve*, exsertile vesicles; *st*, stylet; *m*, muscles. × 40.

Fig. 4. Eighth abdominal segment, ♀, ventral aspect. *sc*, subcoxa; *st*, stylet; *o*, process of ovipositor. × 40.

Fig. 5. Ninth abdominal segment, ♀, ventral aspect. *sc*, subcoxa; *st*, stylet; *o*, process of ovipositor. × 40.

Plate III.

Structural details of *Petromachilis longicornis*.

Fig. 1. Lateral view of insect, ♀ (body-length 10 mm.). × 6.

Fig. 1 a. Two basal segments of antenna. × 62.

Fig. 1 b. Segments from about middle of antenna, showing grouping. × 62.

Fig. 2. Diagram showing shape and positions of compound eyes (*e*), lateral ocelli (*o*), and median ocellus (*mo*). × 62.

Fig. 3. Right mandible of female, hinder aspect. *a*, apex; *m*, molar area; *c*, condyle. × 62.

Fig. 4. Terminal region of the same mandible, showing blunt teeth at apex (*a*). × 280.

Fig. 5. Left maxillula, inner view, showing teeth on inner side of lacinia (*l*.). *g*, galea. × 124.

Fig. 6. Right maxilla of female, hinder aspect. *c*, cardo; *st*, stipes; *l*, lacinia; *g*, galea; *p*, palp. × 62.

Fig. 6 A. Head of lacinia showing apex (*a*), "brush" (*b*), and acute processes (*c* and *d*). × 280.

Fig. 7. Labium of female, showing submentum (*m*) and mentum (*l*). *p*, palp. × 62.

Fig. 7 A. Sensory spines from apex of labium. × 280.

PLATE IV.

Structural details of *Petromachilis longicornis* (continued).

Fig. 1. First abdominal segment, ♀, ventral aspect. *s*, sternum; *sc*, subcoxa; *ve*, exsertile vesicle. × 62.

Fig. 2. Second abdominal segment, ♀, ventral aspect, showing two pairs of exsertile vesicles (*ve*). *s*, sternum; *sc*, subcoxa; *st*, stylet. × 62.

Fig. 3. Third abdominal segment, ♀, ventral aspect. *s*, sternum; *sc*, subcoxa; *st*, stylet; *ve*, exsertile vesicles. × 62.

Fig. 4. Fourth abdominal segment, ♀, ventral aspect. *s*, sternum; *sc*, subcoxa, *st*, stylet; *ve*, exsertile vesicles. × 62.

Fig. 5. Fifth abdominal segment, ♀, ventral aspect. *s*, sternum; *sc*, subcoxa; *st*, stylet; *ve*, exsertile vesicles. × 62.

Fig. 6. Sixth abdominal segment, ♀, ventral aspect. *s*, sternum; *sc*, subcoxa; *st*, stylet; one pair of exsertile vesicles (*ve*). × 62.

Fig. 7. Seventh abdominal segment, ♀, ventral aspect, showing subcoxæ (*sc*) produced into prominent rounded lobes. *s*, sternum; *st*, stylet; one pair of exsertile vesicles (*ve*). × 62.

Fig. 7 A. Seventh abdominal segment, ♂, ventral aspect. *s*, sternum; *sc*, subcoxa; *st*, stylet; one pair of exsertile vesicles (*ve*). × 62.

PLATE V.

Structural details of *Petromachilis longicornis* (continued).

Fig. 8. Eighth abdominal segment, ♀, ventral aspect. *sc*, subcoxa; *st*, stylet; *o*, process of ovipositor. × 62.

Fig. 8 A. Eighth abdominal segment, ♂ (immature), ventral aspect. *s*, sternum; *sc*, subcoxa; *st*, stylet; *g*, gonapophysis. × 124.

Fig. 9. Ninth abdominal segment, ♀, ventral aspect. *sc*, subcoxa; *st*, stylet; *o*, process of ovipositor. × 62.

Fig. 9 A. Ninth abdominal segment, ♂, ventral aspect. *sc*, subcoxa; *st*, stylet; *g*, gonapophysis; *p*, penis. × 62.

III.—*Notes on the* Tabanidæ *of the Australian Region.*

By Gertrude Ricardo.

Acanthocera, Macquart.

Hist. Nat. Dipt. i p. 209 (1834); Loew, Dipt. Sudafrik. p. 31 (1860); Schiner, Reise Novara, p 95 (1866); Ricardo, Ann. & Mag. Nat. Hist. (7) xiv. p. 362 (1904).

Acanthocera australis, ♀, sp. n.

Type (female) and another female from Kuranda, N. Queensland, in German Ent. Museum.

This species bears a strong general resemblance to *Acanthocera longicornis*, F., especially in the markings of the wings, and, no doubt, belongs to this genus, though, unfortunately, the third joint of the antenna is destroyed in both specimens. As all the known species of the genus, about seven in number, come from South America, this is the first record of the genus in Australia.

A reddish-brown species with two grey or white-haired stripes on abdomen at base. Antennæ and legs yellowish. Wings dark brown, with the posterior border from apex to anal cell and a few spots clear.

Length 14 mm.

Face shining reddish brown, in the centre raised as a large tubercle; cheeks black with bluish-grey tomentum. Beard composed of sparse brown hairs. Proboscis short, stout. *Palpi* nearly as long, black, stout at base, ending in a fine point, with black pubescence. *Antennæ* reddish yellow, the first joint two and a half times as long as the second joint, both with a few short black hairs, situated on a reddish tubercle forming the subcallus. *Forehead* parallel, about five times as long as it is broad, blackish, with grey tomentum; the frontal callus shining black, tuberculous, pear-shaped, reaching the eyes, and ending in a short point. *Eyes* (when moistened) show two bright green stripes forming a loop on the middle of the eye, not quite reaching the border, the first one starting from the base of the subcallus and the second one just beyond it; they are about ½ mm. in width each.

Thorax mahogany-red with two narrow grey tomentose stripes. *Scutellum* same colour. *Abdomen* long and narrow, the same colour on the two basal segments, the remaining segments becoming darker, the posterior borders of the first two segments bordered with white hairs on a grey tomentose ground-colour; dorsum otherwise appears devoid of pubescence; underside the same, a little darker. *Legs* mahogany-brown, the fore femora and the tibiæ dull reddish yellow; the tarsi the same, becoming darker on their apical joints. *Wings* dark brown, with clear streaks in the base of the marginal cell, in the upper part of the submarginal cell, in the two basal cells, and in the discal cell, and smaller ones in the anal and fifth posterior cells, but more marked than these is one clear spot in the base of the first basal cell and one clear spot in the apices of each basal cell; all the posterior border of wing from the apex to the anal cell is clear, the brown colouring continuing in a straight line to the fork of the third vein and then forming a straight line across the top of the discal cell to the apex of the anal cell, the axillary angle beyond is clear.

Species of Tabanus *from New Zealand.*

Mr. Arthur White informs me that the fauna of New Zealand has little or no relationship with that of Australia.

Very few species of the genus have been recorded from these islands, and the material in the Brit. Mus. Coll. is very scanty.

Hutton, in Trans. New Zealand Inst. i. p. 11, 1900, gives a list of eight species which are now reduced to six as follows:—

Tabanus sordidus, Wlk.,
Tabanus transversus, Wlk.,
Tabanus oplus, Wlk.,
Tabanus sarpa, Wlk.,
Tabanus bratnankii, Norvicki,
Tabanus viridis, Hutton,

and *Tabanus truncatus*, Wlk., which is *not* a synonym of *Tabanus sarpa*, Wlk., as Hutton states in his list.

His species, *T. viridis*, is unknown to me, as is *T. bratnankii*, though I have studied the fairly full description by the author, who says the prevailing colour is isabelline, the eyes hairy, the forehead of female narrow and parallel, with a small yellowish-coloured frontal callus, antennæ reddish, the last joint black, the legs red with black femora, abdomen dark brown with an uninterrupted median stripe, and angles and sides of segments leather-yellowish in colour; the length is given as 13–14 mm., and the locality Queensland.

T. transversus was included in the species from Australia by an oversight in my paper in Ann. & Mag. Nat. Hist. (8)

xiv. p. 390 (1914), *T. sordidus* and *T. transversus* belong to Group VII., *T. truncatus* to Group IX., and *T. sarpa* and *T. op[illegible]s* to the subgenus *Therioplectes*, or hairy-eyed Group XI.

Tabanus sordidus, Walker, List Dipt. v. p. 256 (1854).

Type (female) from New Zealand (*presented by Col. Bolton*).

A species bearing some resemblance to *Tabanus laticallosus*, Ricardo, but distinguished by the wider forehead and square frontal callus, and by the black broad stripe on the abdomen reaching the apex. *Antennæ* incomplete. *Legs* blackish.

Length 17 mm.

Face blackish with grey tomentum and long pale yellow hairs. Beard more yellow in colour. *Palpi* reddish yellow with black pubescence, large and stout, ending in an obtuse point, almost the same width throughout. *Antennæ* incomplete, the first two joints dull reddish with black hairs. *Eyes* bare. *Forehead* broad, about four times as long as it is broad anteriorly, covered with yellowish-grey tomentum; frontal callus blackish brown, almost square, and nearly touching the eyes; the lineal extension spindle-shaped, on the vertex appears a small black callus with what appear very like three small ocelli, but the species is a genuine *Tabanus*. *Thorax* black, denuded. Walker describes it as having three hoary stripes, sides with pale yellow hairs, and black hairs above the wings. *Scutellum* black. *Abdomen* tawny, the same colour as the first segment, almost wholly black, the three following segments each with a large blackish square spot not quite reaching the posterior border of segment, the last three segments almost wholly black; pubescence on dorsum black; underside tawny black at the extreme apex only. *Legs* blackish, incomplete, Walker says the posterior tibiæ are tawny. *Wings* grey, tinged with brown on fore border and along all the veins; no appendix; veins brown.

Tabanus truncatus, ♀, Walker, in Newman, Zoologist, viii. Appendix lxx. (1851), et List Dipt. v., Suppl. i. pp. 255, 451 (1854); Hutton, Cat. New Z. Diptera, &c. 20 (1881), et Trans. New Z. Inst. p. 13 (1900).

Mesomyia maoriorum, ♂, Bigot, Mém. Soc. Zool. Fr. v. p. 621 (1892); Ricardo, Ann. & Mag. Nat. Hist. (7) viii. p. 297 (1901).

Type (female) from New Zealand (*Col. Bolton*) and others; also a female from Wellington in the Cockayne Coll. Type (male) from New Zealand (*Col. Bolton*) and others in the Cockayne Coll. from Wellington.

A small blackish species with a median stripe of grey triangular spots on the abdomen. Forehead in female broad. Palpi reddish yellow, cylindrical.

Length (males) from 7–8 mm.

Length (females) from 7–10 mm.

Female. *Face* covered with ashy-grey tomentum and with black hairs. Beard white. *Palpi* yellowish covered with thick black pubescence, almost the same width throughout, ending in an obtuse point. *Antennæ* blackish, the first two joints paler with black hairs; the third joint with a small tooth represented by an angle in the middle of the first division. *Forehead* same colour as face, with black hairs; narrower at vertex, about twice as long as it is broad anteriorly; frontal callus brown, small, nearly square, with a short lineal extension, far from the borders of the eyes, which are bare. *Thorax* blackish, with two grey tomentose stripes; shoulders also grey, some appressed fulvous pubescence on dorsum and a few longer black hairs. *Scutellum* blackish covered with grey tomentum. *Abdomen* blackish, the triangular spots present on the second, third, and fourth segments, largest on the second segment, the segmentations grey tomentose, the pubescence on the spots pale fulvous, elsewhere chiefly black; underside with grey tomentose bands. *Legs* reddish yellow, the femora reddish brown, some fulvous pubescence on the middle and hind tibiæ, elsewhere chiefly black. *Wings* clear, with yellowish-black veins; no appendix; all posterior cells widely open.

Male is identical. *Palpi* with long black hairs. *Face* with thick black pubescence, some black hairs present on the subcallus and between the eyes reaching to the vertex. *Eyes* with the upper facets only a little larger than those of lower part of eyes; in undenuded specimens the pubescence on abdomen is thick, and a distinct triangular spot is present on the fifth segment.

Bigot's type, as published by me in 1900, is identical with the male specimens of this species, but *Tabanus sarpa*, Walker, is not identical, as affirmed by Prof. Hutton, who no doubt had not seen the types.

Tabanus oplus, ♂, Walker, List Dipt. i. p. 175 (1848) [sine descr.]; Newman, Zoologist, viii. Appendix lxx. (1850), et List Dipt. v., Suppl. i. p. 255 (1854).

Tabanus gravis, Hutton, Trans. New Z. Inst. xxxiii. p. 13 (1901).

Male (type) from New Zealand (*presented by Dr. A.*

Sinclair) and other males from New Zealand (*Col. Bolton and H. Clark*). One male from Wellington in the Cockayne Coll. One female from New Zealand (*Col. Bolton*). Two females from Wellington in the Cockayne Coll.

A small species with a reddish-yellow abdomen marked with median black spots. Antennæ slender, the first two joints yellowish, the third black. Palpi and legs yellow.

Length (male type) 10½ mm., others 12–13.

Female (type) 10½–12 mm.

♂. *Face* covered with yellowish-grey tomentum and with short brown hair on cheeks, centre of face depressed. *Palpi* pale yellow, the second joint with black hairs and long white hairs at the apex. Beard white, thick. *Antennæ* reddish yellow, the third only so at its extreme base, then blackish; the first two joints with thick black pubescence, the third joint slender, with a distinct tooth or angle, on which a few hairs are apparent. *Eyes* with short sparse pubescence, the large facets only cover about half the surface of the eye, and are not much larger than the others; they do not quite reach the hind border.

Thorax raw umber, covered with rather dense pale pubescence; hairs on shoulders and at sides dark and longer; breast with thick white pubescence. *Scutellum* identical. *Abdomen* amber-brown; the black spot on the first segment very small, on the second one oblong, almost attaining the width of segment, those on the next two segments more square as also on the remaining segments; in some of the males the apex is almost entirely blackish; all segmentations rather paler; pubescence on dorsum short, black, becoming longer at the apex and at sides; underside paler. *Legs* pale amber-brown, with long pale hairs on the coxæ and femora and underside of tibiæ, elsewhere black, in some of the males the femora are blackish or reddish brown on their basal halves. *Wings* large, clear, pale yellow on the costal border; stigma pale yellow; veins yellow, those on the fore border black and stouter.

♀. Identical, hairs on face and antennæ not so numerous. *Palpi* slender, ending in a long point, yellow; the first joint with long yellowish hairs, the second joint with black pubescence, two-thirds the length of proboscis. *Forehead* slightly narrower at vertex, about five times as long as it is wide anteriorly; the frontal callus pale yellow or brown, small, with a lineal extension. *Abdomen* with less pubescence. In the females from Wellington the black median stripe is not very distinct, and in all the females it is narrower and composed of ill-defined narrow spots forming a stripe, the apex not darker.

Tabanus sarpa, ♀, Walker, List Dipt. i. p. 175 (1848), et v. Suppl. i. p. 255 (1851).

Tabanus impar, ♀, Walker, Newman, Zoologist, viii. Appendix lxxi. (1850), et List Dipt. v., Suppl. i. p. 256 (1854).

Female (type) from New Zealand, 44–99 (*Pelerin*), and another 97, 86 (*H. Clark*), also from New Zealand. Male (type of *impar*) from New Zealand.

A moderate-sized blackish species with well-marked grey median spots on abdomen. Forehead with a large triangular dark callus. Legs and antennæ blackish.

Length 14–15 mm. (females).

Hind tibiæ with spurs!

♀. Face covered with ashy-coloured tomentum and white and brown hairs. Beard thick, white. Palpi small, reddish yellow, with grey tomentum and black pubescence, ending in a point. Proboscis rather long for a *Tabanus* species, probably 3 mm. Antennæ with the first two joints reddish yellow and with black hairs, the third black, with a distinct tooth; shape of antennæ normal. Forehead a little narrower at vertex, about four times as long as it is broad anteriorly; the large callus almost reaching the border of eyes, with a short lineal extension, or, rather, ending in a short point, in the other female it is more drawn out; colour same as face. Eyes with short but thick pubescence. Thorax blackish brown, with four narrow grey tomentose stripes, the median ones broken off at the middle suture, with two spots on posterior border almost connecting with them; shoulders reddish with black hairs; pubescence on thorax appressed and pale, with some black hairs. Scutellum same colour as thorax, with a grey outer border fringed with long black hairs. Abdomen blackish, the four grey median spots on the second and following segments very distinct; fore borders of second segment also grey tomentose; pubescence black, on spots white; underside with grey tomentum. Legs blackish, tibiæ reddish brown, some white pubescence on femora and on tibiæ, elsewhere black. The hind tibiæ have two distinct spurs, but as no ocelli are present and the shape of antennæ, forehead, and palpi is very similar to species of *Tabanus*, it seems inadvisable to create a new genus for it at present. Wings clear; veins and stigma brown.

♂. Is identical, but the abdomen much more fulvous, leaving the central part black. Eyes appear to have the facets all equal, or if any larger ones are present they are not very noticeable.

PANGONINÆ.

The genus *Pangonia* in *sensu stricto* is only represented in Australia by two or three species, all doubtful.

The other three subgenera are fairly well represented, *Corizoneura* having the smallest number of species. The material in the Brit. Mus. Coll. does not increase very largely, which is a disadvantage, as many of Walker's types are old and worn.

For a list of the Australian species of Pangoninæ, see Ricardo, Ann. & Mag. Nat. Hist. (7) v. p. 112 (1900). To *Erephopsis* species therein named, *E. maculipennis*, Macq., *E. novæguinensis*, Ricardo, and *E. bancrofti*, Austen, must be added.

To *Diatomineura* species add *D. ruficornis*, Macq., *D. hirticeps*, Nowicki, *D. ricardoi*, Hutton, and *D. dives*, Macq. (*Corizoneura*).

From *Corizoneura* species delete *C. angusta*, Macq., *C. trichocera* and *C. rubiginosa*, Bigot, belonging to other genera. *C. alternans* and *C. sulcifrons*, Macq., are probably South African species, see Austen, 'Blood-sucking Flies,' p. 53 (1909), which with synonyms reduces the old species of *Corizoneura* from Australia to seven.

PANGONIA, Macq.

Subgenus *Erephopsis*, Rond.

Erephopsis gibbula, ♀, Walker, List Dipt. i. p. 140 (1848); Riçardo, Ann. & Mag. Nat. Hist. (7) v. pp. 112, 117 (1900).

Erephopsis vertebrata, Bigot, Mém. Soc. Zool. de France, v. p. 618 (1892).
Diatomeneura carnea, Bigot, l. c.

The type came from West Australia, Bigot's two types from Australia. The identity of the latter types is self-evident at a glance—it is difficult to understand how the author made the mistake!

It is a small species, at once distinguished by the unusual shape of the second joint of the palpi, which is shorter than the first one, short and broad, spoon-shaped, reddish in colour; the first joint yellower, with long whitish hairs below, the second joint with short black pubescence. *Face* is very protuberant, reddish with black hairs. Beard yellow. *Antennæ* reddish. *Forehead* a third wider anteriorly, reddish covered with ashy-grey tomentum. *Ocelli* present. *Eyes* hairy. *Thorax* chestnut-brown with four distinct grey tomentose stripes, some whitish hairs at base of wings. *Abdomen* appears blackish brown, covered with ashy-grey tomentum which leaves a median stripe of the ground-colour free; pubescence short, black. *Legs* reddish, posterior ones brown. *Wings* clear, reddish yellow, the first posterior cell closed.

Length of *E. vertebrata* 9½ mm., of *D. carnea* 11 mm.

Erephopsis tricolor, Walker, List Dipt. i. p. 139 (1848); Ricardo, Ann. & Mag. Nat. Hist. (17) v. pp. 112–117 (1900).

Type (female) from Perth, West Australia (*G. Clifton*), 47, 109; and another female from Kelmscott, West Australia (*Dr. J. Cleland*).

One female from South Perth, W. Australia (*Grant Watson*, per Janson), in Mr. Wainwright's Coll.

This small species may be at once recognized by the dark spots on the *wings*, one round one at the base of fork of third vein and another at apex of discal cell; there are also dark blotches on the cross-veins and the fore border is brown. *Forehead* parallel, covered with ashy-grey tomentum and with an indistinct reddish-brown callus. *Antennæ* and *legs* reddish. *Abdomen* blackish with testaceous segmentations.

Erephopsis aureohirta, ♀, Ricardo, Ann & Mag. Nat. Hist. (7) v. pp. 112, 116, pl. i. fig. 10 (1900).

A series of females in Mr. Wainwright's Coll. from Herberton and Kuranda, Queensland (*F. P. Dodd*).

The *forehead* in this species is almost half as wide again anteriorly as it is at vertex, covered with yellowish-brown tomentum and with some short black hairs; frontal callus indistinct, small, pear-shaped, reddish or brown, when denuded a long dark stripe is visible.

Length of these females 14–16 mm.

E. maculipennis, Macq., from east coast of New Holland, must be nearly allied to this species, but the description speaks of the legs being chiefly reddish; the wings have an appendix, and white hairs are present on the sides of most of the segments; the length given is 14 mm., and black median spots are said to be present on the first two segments.

Erephopsis gemina, ♀, Walker, List Dipt. i. p. 138 (1848), [*Pangonia*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. pp. 112, 117 (1900).

Pangonia testaceomaculata, ♂, Macq. Dipt. Exot., Suppl. iv. p. 325 (1849).

Type (female) from Perth, W. Australia (*G. Clifton*), 47, 109; another female from Australia (purchased, Argent, 50. 1. 7); two females from Perth (*H. W. J. Turner*), 93. 198; one female from Sydney, New South Wales (purchased, Lambert, 47. 73), all in Brit. Mus. Coll. Two females from South Perth (*Grant Watson*, per Janson), in Mr. Wainwright's Coll. *P. testaceomaculata*, male (type), in the Verrall Coll.

♀. A reddish-brown species with reddish legs, black antennæ, short stout palpi, very hairy face and forehead, the latter broad. Wings with the posterior cell closed or very narrow, the cross-veins slightly clouded.

Length 15 mm. (type), others 12–15 mm.

Face reddish, covered with grey tomentum and with long brownish hairs, some white ones intermixed, face slightly convex, cheeks with ashy-grey tomentum. Beard yellowish white. Proboscis over 4 mm. long. *Palpi*: the second joint orange-rufous with black pubescence, broad, short, and stout, ending in a short point. *Antennæ* blackish, the first two joints with some grey tomentum and many long black hairs on their upper and lower sides. *Eyes* with very distinct pubescence. *Forehead* reddish, with some grey tomentum and black pubescence, with a tubercle of the same colour representing the frontal callus, quite a third broader anteriorly than at vertex. *Thorax* blackish brown, with two lineal grey tomentose stripes on the anterior half of the dorsum only, sides with whitish long hairs reaching the scutellum; black on the shoulders, some long black hairs on the dorsum of thorax and on scutellum. *Abdomen* reddish on the first three segments; a transverse median black spot on the first segment, on the second an almost square black median spot, the third black on its anterior border, the remaining segments blackish, their posterior borders reddish or slaty grey, with traces of median whitish-haired small spots on the apical segments; pubescence on dorsum black, at sides chiefly white mixed with some black hairs towards the apex; underside more largely reddish with white pubescence. *Legs* reddish with black pubescence. *Wings* clear, slightly yellow at base and fore border.

♂. Is identical. *Palpi* appear very much the same shape, but smaller, as in the female; the dirty condition of the type makes it difficult to describe them more fully. The white-haired spots on abdomen are very distinct on nearly every segment, the reddish-yellow colour is more predominant, the third segment being entirely so, with the exception of a black spot like that on the second segment.

Length 14 mm.

Erephopsis contigua, ♀, Walker, List Dipt. i. p. 138 (1848) [*Pangonia*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. pp. 113, 116 (1900).

Type (female) from Australia and another from New South Wales in Brit. Mus. Coll.

A series of females and males in Mr. Wainwright's Coll., from Kuranda, Queensland (*F. P. Dodd*).

A species with the markings on the wings very similar to those of *E. aureohirta*, Ricardo, but at once distinguished by its smaller size and wholly yellowish legs.

Length of these specimens in Mr. Wainwright's Coll.: females 12½–13 mm.; males 11–12 mm. Proboscis 2¾ mm.

♀. *Face* protuberant, shining in centre, reddish yellow with grey tomentum, divided from cheeks by a deep furrow. *Palpi* orange-rufous, the first joint yellow, the second joint large and wide, concave, tapering to a short point, fringed with black hairs. Beard yellowish white. *Antennæ* orange rufous, the first two joints yellow, with some black hairs, which are long on the second joint. *Forehead* almost half as wide again anteriorly as it is at vertex; reddish, with grey tomentum; when denuded a callus extending to a stripe is visible, the callus being spindle-shaped. *Thorax* reddish brown, with black pubescence; hairs on shoulders black, then yellowish, reaching to base of thorax; dorsum with some grey tomentum. *Scutellum* identical. *Abdomen* ferruginous, the first two segments yellowish with irregular small black spots; pubescence on dorsum black. *Legs* pale yellow, the tarsi a little darker; pubescence black. *Wings* with a fore border and apex and two dark bands brown—in fact, the whole wing may be described as brown, having the middle of the first posterior and the greater part of the discal cell clear; both the basal cells, with the exception of their bases and apices, clear, also the anal cell clear, and beyond the brown fades away, leaving the axillary angle almost wholly clear; no appendix is present, the first posterior cell is closed at border.

♂. Is similar, facets of eyes almost uniform in size. *Palpi* as large as those of the female, more hairy. *Abdomen* almost wholly yellow on the three first segments, with thick black pubescence at the sides, mixed with some yellow hairs at apex. *Wings* with the first posterior cell just open at border or closed.

Walker, in Suppl. v. p. 139 (1854), makes this species a synonym of *Pangonia fuliginosa*, Bois, from New Guinea, but, judging from the description of this last species, he was probably in error.

Erephopsis guttata, Donovan, Gener. Illustr. Ent. i., Hym. et Dipt. (1805); Wied. Auss. zweifl. Ins. i. p. 194 (1830) [*Tabanus*]; Guérin, Voyage de la 'Coquille,' Zool. ii. p. 289, pl. xx. fig. 10 (1830) [*Tabanus*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. pp. 112, 114 (1900); Froggatt, Science Bull. New South Wales, iii. p. 5 (1911) [*Pangonia*].

Pangonia margaritifera, Wied. Auss. zweifl. Ins. i. p. 88 (1830); Macq. Dipt. Exot. Suppl. iii. p. 8 (1847), Williston, Kans. Univ. Quart. iii. p. 191 (1895).
Pangonia albonotata, Macq. Dipt. Exot., Suppl. v. p. 40 (1855).

Males and females from Sydney, Brisbane, and Queensland in Brit. Mus. Coll.

One female in Mr. French's Coll. from Dandenong Ranges, Victoria.

Macquart's species in the Verrall Coll. is identical. A large black species marked with median white abdominal spots and with white hairs on sides of thorax.

Erephopsis media, Walker, List Dipt. i. p. 142 (1848) [*Pangonia*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. pp. 112, 114 (1900).

Pangonia limbinervis, Macq. Dipt. Exot., Suppl. v. p. 41 (1855).

Macquart's type in the Verrall Coll. is identical with this species.

Erephopsis cinerea, ♀, sp. n.

Type (female) and another from Swan River, W. Australia (*G. C. Shortridge*), 1906, 293, in Brit. Mus. Coll.

A small black species, allied to *E. macroporum*, Macq., in the shading of the wings. Antennæ, palpi, and legs blackish.

Length 10 mm. Proboscis 2 mm.

Face reddish brown, convex in the centre, with some long dark hairs on the cheeks. Beard dirty white. *Palpi* small, the second joint shorter than the first joint, broad and concave, ending in a short fine point with long dark hairs below. *Antennæ* blackish, the first two joints with long black hairs. *Forehead* same colour as face, a little wider anteriorly, about five times as long as it is broad, with dark thick pubescence. *Eyes* very hairy. *Thorax, scutellum*, and *abdomen* blackish, the thorax with three distinct grey tomentose stripes. *Legs* uniformly blackish brown, and with black pubescence, even on the coxæ. *Wings* grey, more intense in colour in the cells, the first posterior cell closed far from the border; stigma large, brown; veins brown.

Diatomineura auriflua, Donovan, Gen. Illustr. Ent. Hym. et Dipt. (1805) [*Tabanus*]; Wied. Auss. zweifl. Ins. i. p. 194 (1848) [*Pangonia*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. pp. 112, 119 (1900); Froggatt, Science Bull. New South Wales, iii. p. 5 (1911) [*Pangonia*].

Pangonia solida, Walker, List Dipt. i. p. 141 (1848).

Females from Sydney, New South Wales, or Moreton Bay, Queensland; from Port Stephen, New South Wales, and Tasmania in Brit. Mus. Coll. Two males and three females from Dandenong Ranges, Victoria, in Mr. French's Coll.

Diatomineura jacksoniensis, Guèrin, Voyage de la 'Coquille,' ii. pt. 2, p. 289 (1830); Atlas, Ins. pl. xx. 3; Ricardo, Ann. & Mag. Nat. Hist. (7) v. pp. 113, 118 (1900).

One female from Melbourne (*Braby*), 53, 55 in Brit. Mus. Coll.

Two females from Queensland in Mr. French's Coll.

These females appear to belong to this species, judging from the original description.

Guèrin gives the length as 17 mm.

A stout species with orange-rufous *antennæ, palpi*, and *legs*. *Abdomen* mahogany-red with black markings and very narrow golden-haired segmentations, chiefly confined to the middle of the posterior segments. The *wings* are large, grey, with the first posterior cell slightly narrowed at the border; no appendix. The *thorax* is blackish brown, with tufts of yellow hairs at sides and base of wings. The *palpi* are long, almost half the length of the proboscis, the second joint wide and concave at base, ending in a long slender point. *Forehead* parallel, covered with yellowish-grey tomentum and with an obscure ill-defined frontal callus. Beard yellow.

Length of these females 14–16 mm. Proboscis 1½ mm.

Diatomineura clavata, ♂, Macq. Dipt. Exot. i. p. 105 (1838) [*Pangonia*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. p. 113 (1900).

One female from Victoria (*R. Bakewell*), 59. 24 in Brit. Mus. Coll. Two females from Dandenong Ranges, Victoria, in Mr. French's Coll. One of these latter was identified with the type in Paris by the kindness of M. Surcouf, to whom I sent it for comparison.

The following particulars may be added to the original description of the type (a male):—

Face reddish brown, convex, with grey tomentum and fairly long black hairs bordered by some white ones, the cheeks covered with ashy-grey tomentum and with black pubescence. *Forehead* brownish, with grey tomentum and black pubescence. *Palpi* large, concave on the upper side for more than the apical half, with black pubescence. *Antennæ* dull red, the first two joints covered with grey tomentum, with black hairs; hind part of head with white hairs, at vertex black. Beard yellowish white. Pubescence of dorsum of *thorax* black, at sides and at base of wings and posteriorly white, *scutellum* bordered with white hairs. The white spots mentioned by Macquart as on sides of segments of abdomen are tufts of white hairs at the sides with black hairs above them, the pubescence on dorsum black; the white dorsal spots are indicated on the second, third, and fourth segments; the first segment and anterior border of second are obscurely reddish, the rest of the abdomen bluish black. Pubescence of *legs* black.

Length 14 mm.

Diatomineura brevirostris, Macquart, Dipt. Exot., Suppl. iv. p. 326 (1842) [*Pangonia*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. p. 113 (1900).

A series of females from Mackay, Queensland (*G. Turner*), 94. 61; from Brisbane (*H. Tryon*), 1907, 285; from Burpengary, Queensland (*Dr. T. L. Bancroft*), 1904, 93; from Kuranda, Queensland (*Dodd*), 1914, 281 in Brit. Mus. Coll.

Three females from Herberton, Queensland, 3000–4000 ft. (*F. P. Dodd*), Dec. 1910, in Mr. Wainwright's Coll.

Macquart's description is as follows:—

"Black. Abdomen red at base. Ocelli hairy. Antennæ and legs red. Wings with no appendix; first posterior cell open. Length 8 mm., ♀. Related to *Pangonia ruficornis* (from Tasmania). Proboscis 2 mm. long, with large terminal lips. Beard yellowish white. Face and anterior part of forehead tawny, with sparse white tomentum; posterior part of forehead black, with brown tomentum; callus indistinct; ocelli present. Antennæ bright tawny. Eyes with white pubescence, short and indistinct. Thorax (denuded) shining black; a testaceous stripe above the base of wings, with traces of white hairs; sides testaceous, with whitish tomentum. Abdomen (denuded), first segment testaceous, second blackish, with the sides and the posterior border testaceous, the others shining black; underside brown, changing to white, segmentations white. Tarsi brown. Wings at base and on fore border a little reddish; stigma yellow. From the east coast of New Holland. Museum."

This must be very nearly related to *D. ruficornis*, Macq, if not the same; the type of the latter is in the Lille Museum, or was some years ago.

A small reddish-brown species, with yellowish-white tufts of hairs at sides of thorax and base of wings. Frontal callus small, often very indistinct. Antennæ and legs reddish yellow.

Length 9–10 mm.

Face reddish yellow, covered with grey tomentum, and with short black pubescence, centre convex, divided from the cheeks by a deep furrow. Beard yellowish. *Palpi* orange-rufous, wide at base, ending in a long fine point, with a few black hairs very similar to those of *D. testacea*, Macq., from which species it may be distinguished by its smaller size and darker colouring and tuft-like hairs on thorax. *Antennæ* same as those of *D. testacea*. *Forehead* parallel, about four times as long as it is broad, reddish brown, with grey tomentum, which is most noticeable anteriorly; posteriorly the forehead is darker; frontal callus appears as a small round black spot, or, if denuded, as pear-shaped. *Eyes* with distinct dark pubescence. *Thorax* mummy-brown, with yellowish-grey tomentum, often appearing as three narrow stripes; shoulders with dark hairs, sides from thence to scutellum with thick yellowish tufts of hairs. *Scutellum* same as thorax, with some short dark pubescence. *Abdomen* same colour as thorax, but reddish on sides of first two segments and on posterior borders of the others, with whitish- or yellowish-haired median spots from the first or third segment to apex, and fringes of short yellow hairs on the posterior borders of the fifth and sixth segments at least; underside covered with yellowish-grey tomentum. *Legs* uniformly reddish yellow. *Wings* clear, yellowish at base and on fore border; veins reddish yellow; no appendix present; first posterior cell widely open.

Diatomineura violacea, Macquart, Dipt. Exot., Suppl. iv. p. 326, pl ii. fig. 8 (1849) [*Pangonia*].

Two females from Kuranda, N. Queensland (*F. P. Dodd*). Presented by F. H. Taylor (1914). In Brit. Mus. Coll.

Three females from Cairns, N. Queensland, 1907.

One male (type) from Herberton, in German Ent. Museum Coll.

The type was described as from Tasmania. Macquart's description does not altogether suit these specimens, as he makes no mention of the lighter colour of legs, only alluding to the knees as a little testaceous, and his figure of the head shows the palpi as slender, whereas in these they are very broad. However, I have little doubt they are this species. It is just possible that the locality specified may be incorrect, as Mr. A. White writes to me that in his three years' collecting in Tasmania he has only come across three species of *Pangonia*, and this is not one of them.

A small metallic-blue species with bright reddish-yellow antennæ and palpi.

Length 8 mm.

♀. *Face* dark, with some grey tomentum and with black pubescence. Beard blackish (Macquart speaks of it as tawny). Proboscis 2 mm. long. *Palpi* short, reddish yellow, the second joint broad, ending in an obtuse point, the upper edge curved. *Antennæ* reddish yellow, the first two joints yellowish, with black hairs. *Eyes* hairy. *Forehead* parallel, about five times as long as it is broad, covered with grey tomentum and some short dark hairs; frontal callus small, oblong, not reaching eyes, with a lineal extension. Ocelli present. *Thorax, scutellum,* and *abdomen* blue, metallic, shining, some traces of grey tomentum on the thorax and also on the underside of abdomen. *Legs* blackish, all the tibiæ and tarsi a dull yellowish in the specimens from Cairns and Herberton. *Wings* large, extending far beyond the abdomen, clear; stigma yellowish; veins brownish; first posterior cell open, but slightly narrowed at border.

♂. Is similar, the black hairs on the face are very long and thick, and also numerous on the first two joints of antennæ. *Palpi* yellow, with thick black pubescence. *Legs* blackish, the pulvilli very much larger than in female, with abnormal bright yellow prolongations four or more in number.

Diatomineura testacea, ♀, Macq. Dipt. Exot. i. p. 108 (1838) [*Pangonia*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. p. 113 (1900).

This species and the two following new species, *D. montana* and *D. inflata*, are all nearly related, with abdomen almost wholly reddish yellow; wings clear, with no appendix. Antennæ and legs yellow. The species may all be recognized by the different form of the palpi in each.

Macquart's type is probably lost. The following is his description:—

"Testaceous. Antennæ red. Eyes hairy. Legs red. Wings with no appendix; the first posterior cell half open. Length 12 mm., ♀. Proboscis black, 3 mm. long, a little stout, with the terminal lips swollen. Palpi tawny, of the usual form. Face not protuberant, yellowish grey. Forehead brownish tawny, with no callus. Antennæ bright tawny. Ocelli present. Thorax tawny, with brown stripes; sides with yellowish-grey hairs. Abdomen testaceous red, unicolorous; underside a light yellowish grey, a little greenish. Legs tawny. Wings greyish, at base yellowish; the second submarginal cell with no appendix; the first posterior cell half open."

One male and one female in Brit. Mus. Coll. from Kuranda, Queensland (*F. P. Dodd*), 1914, 281. Two females in German Ent. Museum from Cairns, Queensland, and Kuranda, Queensland (*F. P. Dodd*), Sept. 1910.

A male and female in Mr. Wainwright's Coll. also from Kuranda by the same collector.

The *palpi* are long and slender, more than half the length of the proboscis, wide on the basal half, with the upper border curved, but ending in a fairly long fine point, orange-rufous in colour, with scattered, black, short pubescence. *Face* covered with yellowish-grey tomentum, in the centre raised a little beneath the antennæ, on the lower half more concave than convex, separated from the cheeks by a deep furrow; some long dark hairs are visible on the sides of the centre of face and yellowish hairs on the lower part of cheeks; the beard is also yellowish white.

Antennæ orange-rufous, the first two joints pale yellow, with black hairs. *Forehead* parallel, about five times as long as it is broad, with no distinct callus, but owing to denudation a central black line is often visible; colouring is a shade darker than the face, with some short black hairs. *Eyes* hairy. *Thorax* reddish brown, covered with yellowish-grey tomentum and appressed fulvous hairs; shoulders honey-yellow, with long brownish hairs; breast with grey tomentum and long whitish hairs. *Scutellum* same as thorax. *Abdomen* amber-brown, paler at the base and darker towards the apex, often with indistinct brownish-red markings; pubescence on dorsum and at sides not noticeable, being very short and black on the dorsum and at the sides, only longer towards the apex; underside as described by Macquart. *Legs* uniformly yellowish, with black pubescence. *Wings* clear yellow at base and on fore border; in most of the specimens the first posterior cell is a little narrowed at border.

Length from 12 mm.; length of proboscis 2 mm.

♂. *Face* not raised so much beneath the antennæ, hairs rather longer and thick; palpi conical, with short black pubescence. *Eyes* with large facets taking up two-thirds of the surface, starting from the base of subcallus and reaching the vertex. *Wings* yellowish on the fore border and at base.

Diatomineura plana, Walker, List Dipt. i. p. 144 (1848); Ann. & Mag. Nat. Hist. (7) v. pp. 113, 118 (1900).

Diatomineura nigricornis, Bigot, Mém. Soc. Zool. de France, v. p. 614 (1892).

Type (female) from Australia in Brit. Mus. Coll.

Bigot's type, from Australia, in poor preservation.

A medium-sized blackish species, with ashy-grey tomentum on face and forehead. Antennæ and palpi reddish yellow. Abdomen with all segmentations yellow- or white-haired.

Length 12 mm.

Face very protuberant, tomentum on lower part yellowish grey; dark hairs on central protuberant face, cheeks almost bare. Beard yellowish white, thick. *Palpi* reddish yellow, the second joint broad at base, tapering to a long point. *Antennæ* with the first two joints blackish, covered with grey tomentum, and with black hairs. *Forehead* parallel, with fairly thick black pubescence; no callus visible. *Eyes* with pubescence thickest on the lower half, reddish, with some white hairs. *Thorax* blackish, covered with appressed fulvous hairs and longer black ones towards the sides, longer white hairs on anterior part of dorsum; two indistinct stripes are visible, with grey tomentum; shoulders reddish, with dark hairs, sides with tuft-like yellowish-white hairs continued to base of scutellum, which has also a fringe of shorter hairs on its posterior border. *Abdomen* blackish brown, the pale-coloured hairs on segmentations nearly a third of the width of the segment, median spots probably well developed in fresh specimens; underside greyish yellow, with short white pubescence. *Legs* blackish, the tibiæ reddish, pubescence black; fore coxæ with very thick yellowish-white hairs; all femora with some pale pubescence. *Wings* clear, the first posterior cell slightly narrowed at border; veins reddish yellow at base and on fore border, darker at apex; stigma yellowish; no appendix.

Bigot's type is in such bad condition, it is difficult to distinguish any pubescence on the eyes, and the wings have an appendix; the first posterior cell is also rather narrower at border. In spite of these differences, it is so like the Walker type in shape of forehead and face, and is so exactly similar in the abdomen, that there is little doubt of its being identical with *D. plana*.

Diatomineura crassa, Walker, List Dipt. i. p. 144 (1848); Ricardo, Ann. & Mag. Nat. Hist. (7) v. pp. 113, 120 (1900).

Pangonia aurata, Macq. Dipt. Exot. i. p. 104, pl. xv fig. 1 (1838).

Type (♀) from ? Australia, and another from between Sydney and Moreton Bay (*Stutchbury*), 56. 94; and males from New South Wales, South Queensland, in Brit. Mus. Coll.

Two males from Katabomba, Blue Mts., New South Wales, 3400 ft. (*Dodd*), 1912, in German Ent. Museum.

A small blackish species, with white- or pale yellow-haired median spots on the second, third, and fourth abdominal segments, the last two or three segments almost wholly covered with golden-yellow hairs and a patch of white hairs on the sides of the second segments; the males have the abdomen largely fulvous in colour.

Pangonia aurata, Macq., from the description is probably identical with this species, but, not having seen the type, Walker's name is retained.

Diatomineura gagantina, Bigot, Mém. Soc. Zool. Fr. v. p. 620 (1892).

Diatomineura minima, Ricardo, Ann. & Mag. Nat. Hist. (7) v. p. 119 (1900).

Having seen Bigot's type, I find my species is the same. The types of *D. minima* in Brit. Mus. Coll. came probably from Moreton Bay, Queensland, others from Queensland. There are three females from Herberton and Kuranda and one male from Herberton, Queensland, in the German Ent. Museum.

This small, narrow-bodied, black species with dark wings is not at all a typical species of *Diatomineura.*

Diatomineura montanus, ♀, sp. n.

Type (female) and another female from Katoomba, Blue Mts., New South Wales, 3400 ft. (*Dodd*), 1912, in German Ent. Museum Coll. One female from Dandenong Ranges, Victoria, in Mr. French's Coll.

This species may be distinguished from *D. testacea*, Macq., by the yellowish tufts of hair on thorax at base of wings, by the protuberant face, and by the palpi, which are broader at the base and, perhaps, a little shorter, and the first posterior cell of wing is widely open.

Length 3 mm.; length of proboscis 2 mm.

Face protuberant for its whole length, reddish, covered with yellowish-grey tomentum, with short brown hairs. *Palpi* and *antennæ* the same colouring as *D. testacea. Forehead* very slightly narrower anteriorly; no callus is apparent; reddish brown, covered with tawny tomentum with short black hairs. *Eyes* hairy. *Thorax* much the same colouring as *D. testacea*, but more reddish; shoulders with long yellowish-white hairs which reach the base of scutellum. *Abdomen* more reddish-looking, partly by reason of the pubescence, which is reddish, short, and rather thick on dorsum. *Legs* a shade darker than *D. testacea. Wings* clear, with yellowish veins and stigma, very slightly yellow at base and on fore border.

Diatomineura inflata, ♀, sp. n.

Type (female) from S. Queensland (*Dr. T. L. Bancroft*), 1908, 72, and other females from unknown localities.

This species may be distinguished from *D. testacea*, Macq., by its larger size, its more protuberant face, and more particularly by the shape of the short stout palpi. The forehead is also not parallel, but wider anteriorly.

Length from 15 mm.; length of proboscis 3 mm.

Face reddish, covered with yellowish-grey tomentum and with some black hairs intermixed with a few white ones; face protuberant, separated from the cheeks by a deep furrow. *Palpi* orange-rufous, with black hairs on the sides and at apex, short, stout, almost conical-shaped. Beard pale yellow. *Antennæ* orange-rufous, the first two joints pale yellow with black hairs, rather thick and stout. *Forehead* nearly half as wide again anteriorly as it is at the vertex, reddish brown, covered with tawny tomentum; no callus visible, black pubescence visible. *Eyes* hairy. *Thorax* blackish, covered with grey tomentum and with appressed yellow hairs; shoulders yellowish, with black and yellow hairs; sides with long yellowish hairs reaching the base of scutellum, which latter has yellow hairs on its posterior border. *Abdomen* amber-brown, darker at apex, some grey tomentum on first segment; dorsum with short black pubescence, and some few yellowish hairs on centre of first, second, and third segments, but those on the fourth, fifth, and sixth segments much more numerous and noticeable; underside pale reddish yellow, with short yellow pubescence. *Legs* amber-brown, with chiefly black pubescence. *Wings* large, clear, yellowish on fore border; veins reddish yellow; no appendix; the first posterior cell narrowed at border.

Diatomineura pulchra, ♀, sp. n.

Type (female) from Yandina, S. Queensland, Feb. 1900 (*H. Tryon*), 1907, 285, and another female from Burpengary, S. Queensland (*Dr. T. L. Bancroft*), 1904, in Brit. Mus. Coll.

A species near *Diatomineura crassa*, Wlk., but distinct, being smaller in size; the abdominal spots are not white, but a bright golden yellow, with none on the second segment, and the apex is not wholly golden-haired.

A handsome small blackish species, with four golden-yellow-haired abdominal spots, and the same-coloured hairs on the thorax.

Length 11 mm.; proboscis 2 mm.

Face reddish, covered with yellowish-grey tomentum, very convex on the centre, separated by a deep furrow from the cheeks; pubescence brown, but very sparse. Beard yellow. *Palpi* stout, wide at base, ending in a short point, orange-rufous in colour, devoid of pubescence. *Antennæ* orange-rufous, the first two joints reddish, covered with grey tomentum. *Forehead* parallel, about three times as long as it is broad, dark brown in colour, anteriorly covered with yellowish-grey tomentum; frontal callus indistinct and small. *Eyes* with short dark pubescence. *Thorax* blackish brown, with golden-yellow hairs on its anterior border, at sides, and on its posterior border. *Scutellum* also covered with them. *Abdomen* reddish brown, covered with short black pubescence; on the third, fourth, and sixth segments appears a large golden-yellow-haired, almost square spot, forming a continuous stripe; on the seventh segment only a small spot is seen; underside covered with grey tomentum. *Legs* uniformly reddish yellow. *Wings* clear; veins reddish yellow; no appendix present; first posterior cell very slightly narrower at border.

Corizoneura chrysophila, Walker, List Dipt. i. p. 155 (1848) [*Tabanus*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. pp. 113, 120 (1900).

Pangonia nigrosignata, Thomson, Eugen Resa, Dipt. p. 451 (1868).

Type (female) and another from Australia, and another from between Sydney and Moreton Bay (*Stutchbury*), 56. 94.

Type (male) from Burpengary, S. Queensland (*Dr. T. L. Bancroft*), 1904.

This handsome species has a blackish abdomen, with broad bands of reddish-yellow hairs on yellow segmentations which are half the width of the segment. *Antennæ, palpi*, and *legs* reddish yellow. *Wings* large, yellowish. In the female the thorax is covered with yellowish tomentum, through which appear four brown stripes. In the male only two short ones at base of thorax are visible. *Forehead* in female is yellowish, broader anteriorly, with a spindle-shaped yellow stripe. *Palpi* same shape and colour as those of *C. fulva*, Macq.; the face is much more protuberant in the female; male with *palpi* the same as those of *C. fulva*, and altogether brighter in colour than the female.

Length 20 mm.; proboscis 1½ mm.

Corizoneura fulva, ♂, Macquart, Dipt. Exot., Suppl. iv. p. 323 (1849); Ricardo, Ann. & Mag. Nat. Hist. (7) v. pp. 113, 120 (1900).

Two males from Sydney (*Lambert*), 47. 73, and from Hunter River, New South Wales. Presented by the Earl of Derby, 44. 105 in Brit. Mus. Coll.

Type (female) from Herberton, N. Queensland (*Dodd*), xii. 1910, 3700 ft., in German Ent. Museum.

Only the male was described by Macquart from the east coast of New Holland.

This large fulvous-coloured species and *Coryzoneura chrysophila*, Walker, from the shape of the palpi and general appearance, will probably require in the future to be placed in a new genus.

C. fulva is at once distinguished by its large size and uniform colouring.

♀. Almost identical with the male, but the *abdomen* s darker in colouring, more reddish brown, with reddish-yellow-haired segmentations. The *thorax* presents a different appearance, being covered with greyish tomentum, through which appear three very distinct reddish-brown stripes a shade darker than the abdomen; in the middle of the median stripe a grey line appears. *Scutellum* covered with greyish tomentum. *Palpi* are very different from others of the genus; the first joint very short, the second long, curved, cylindrical, nearly as long as the proboscis, slightly stouter on basal half, reddish yellow, with black pubescence. *Forehead* almost parallel, a little wider anteriorly, with two round dark spots, and a narrow lineal stripe appears beyond them. *Eyes* quite bare. Ocelli present. *Wings* with the first posterior cell wide open and an appendix present.

Length 18 mm.; proboscis 1 mm.

♂ has palpi rather long, the first joint very stout, the second quite twice its length, cylindrical, with long reddish-yellow hairs. *Antennæ* have the first division of the third joint broad, cone-like in shape, the others small as usual. In the ♀ the third joint is wanting.

Corizoneura neocaledonica, Mègnin, Bull. Soc. Ent. France, (5) viii. p. 145 (1878); id. ix. p. 61 (1879); Bigot, *l. c.* (6) iii. p. 188 (1883) [*Pangonia*].

Corizoneura leucopicta, Bigot, Mém. Soc. Zool. de France, v. p. 615 (1892).

From Mègnin's description there is little doubt that Bigot described the same species. His type (female) and two other females, all from New Caledonia, are in a very dirty condition.

A robust black species. *Abdomen* with median white spots, halfmoon-shaped, on most of the segments, and others at the sides. *Wings* dark brown, with the first posterior cell a little narrowed at border. *Eyes* apparently bare. *Palpi* black, slender. *Antennæ* black. *Forehead* protuberant, a little wider anteriorly. *Legs* blackish.

Length 15 mm.; proboscis 4 mm.

The name *leucopicta* appears crossed through, and *melanoleuca*? substituted, on the label.

Corizoneura conspicua, ♀, sp. n.

Type (female) from Endeavour River, Queensland, in

Mr. French's Coll., and another female from Northern Queensland in Brit. Mus. Coll.

A reddish-brown species with two brown bands on the wings and with bright golden-yellow hairs on sides of thorax, the beard of the same colour. Legs black. Antennæ red. Thorax blackish. Eyes bare. Wings with all posterior cells open.

Length 15 mm. (without proboscis).

It has a general resemblance to *Erephopsis quadrimacula*, Wlk., from which it is distinguished by the bare eyes and open cells of wing. *Pangonia roei*, King, may possibly be identical with this species, but the description is too vague and insufficient to allow of identification.

Face reddish brown, with greyish-yellow tomentum. *Palpi* rather darker, with the base and borders of second joint black, chiefly appearing thus by reason of the short black pubescence, first joint small, the second large, flat, its upper sides straight, the lower one concave, ending in a point. Proboscis long. Beard golden-yellow. *Antennæ*: the first two joints with black pubescence, the third bright red. *Forehead* reddish brown, the space above the antennæ wrinkled, the sides with yellowish tomentum; ocelli distinct on vertex; forehead wide, becoming narrower at vertex. Hind part of head with short black hairs at vertex, otherwise with golden-yellow pubescence. Proboscis long. *Thorax* reddish brown, with some grey tomentum and with golden-yellow pubescence anteriorly, and at sides, above and below the root of wings as long tufts of hair. Sides and breast with golden-yellow pubescence. *Scutellum* the same, with traces of golden-yellow hairs on outer border. *Abdomen* lighter-coloured, with obscure dark brown markings, shining, the pubescence spare, black, at sides golden yellow; underside rather redder, almost bare. *Legs* black, the anterior and middle tibiæ reddish brown, pubescence black, traces of golden-yellow pubescence on the coxæ. *Wings* hyaline, brown at the base and along the fore border, the lower brown band crossing the base of the discal cell, reaching to the base of the fifth posterior cell, the upper band reaching from the fore border just across the apex of the discal cell; veins brown; stigma yellow. Halteres pale yellowish brown.

Corizoneura berylensis, ♂ ♀, sp. n.

Type (female) from Herberton, Queensland (*Dodd*), 11. 1911, 3700 ft.

Type (male) from Kuranda, Queensland (*F. P. Dodd*), 1914. 281. Both in Brit. Mus. Coll.

Males and females in German Ent. Museum from Herberton, Queensland (*Dodd*), 11. 1911, 3700 ft.

Males and females from Kuranda, Queensland (*Dodd*), Sept. 1913.

A small compact species, with a yellowish thorax and reddish-brown abdomen, the latter with yellow-haired median spots forming a stripe. Antennæ, palpi, and legs reddish yellow; forehead parallel, with no frontal callus.

Length, ♀ 8, ♂ 7 mm.; proboscis 1 mm.

♀. *Face* grey, covered with yellowish tomentum and a few short brown hairs in centre, very slightly convex, divided from the cheeks by a deep furrow. Beard pale yellow. *Palpi* tawny, with short black pubescence, the second joint long and slender, wider at base and a little concave, ending in an obtuse point, more than half the length of the proboscis. *Antennæ* xanthine-orange, the last three divisions of the third joint blackish, the first two joints paler, with black hairs; two or three black hairs are visible on apex of third joint. *Forehead* same colour as face, with short black pubescence. *Thorax* buckthorn-brown, covered with short, thick, yellow or yellowish-white hairs, some brown hairs are intermixed with these (in many specimens, owing to denudation, the thorax is nearly bare); sides with longer yellow hairs; breast with whiter hairs. *Scutellum* identical. *Abdomen* raw-umber in colour, with rather thick, short, black pubescence; the yellow-haired stripe is very distinct in good specimens, consisting of a triangular broad spot on the second segment and an almost equal-sized one on the third segment; on the following segments they are wider; underside paler, covered with short, dense, white pubescence. *Legs* yellow-ochre; the coxæ darker, with long white hairs; the femora with long, fine, black hairs, the posterior pair with rather short, thick, yellow hairs; tibiæ and tarsi with black pubescence. *Wings* brown on fore border and at apex; stigma reddish brown; veins yellowish brown; first posterior cell open at border, sometimes a little narrower. No appendix. The spurs on the hind tibiæ are very stout and long.

♂. Very similar. Beard and palpi lighter-coloured, the *palpi* small, the usual shape, with black hairs. *Eyes* with facets all equal. *Abdomen* lighter in colour, more the colour of the antennæ, showing a few isolated round black spots on the dorsum; the yellow-haired stripe much less conspicuous, or, rather, non-existent; the dorsum with only black hairs, and a few yellow hairs on the posterior border of the fourth segment in the centre, and the fifth and sixth segments with their posterior borders wholly yellow-haired; genital organs small but distinct. The tarsi, more especially the anterior pair, with their bases very pale, almost white, then becoming black; this applies only to the last four joints; the first joint is yellow and as long as the four joints together.

IV.—*A new Cestode of the Genus* Zschokkeella.

By H. A. Baylis, B.A.

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[Plate VI.]

Among a collection of parasitic worms recently presented to the British Museum by Mr. C. M. G. Hoyte, from the Gold Coast, there occurred several well-preserved specimens of a Cestode, stated to have been taken from the intestines of a rat. The precise determination of the host was, unfortunately, not given, but in all probability it was the black rat, *Epimys* [*Mus*] *rattus*, which, as I am informed by Mr. Oldfield Thomas, would be the prevailing species in that locality.

When held up to the light and examined with the naked eye, or with a lens, the hinder segments of the worms appeared to be full of small rounded bodies, which were evidently "egg-capsules." These gave the worms a peculiar "speckled" appearance, and seemed at once to indicate that this was not one of the species of tapeworms commonly occurring in rats. Further investigation showed that it was probably a new species, and I shall give reasons for believing that it belongs to a genus of which only one other species was hitherto known to occur in rodents.

Zschokkeella muricola, sp. n.

External Features.

The specimens measure 9–12 cm. in length, and are of typical Cestode shape, being much flattened dorso-ventrally. The body is narrowed rather suddenly in front, forming a slender neck, but there is a rounded knob-like head. Posteriorly the body is also narrowed, but more gradually. The greatest width (about 3·5 mm.) occurs rather behind the middle of the strobila.

The head (Pl. VI. fig 1) is rather wider than the neck, its greatest width being 0·55 mm. There is no rostellum, and the most minute examination fails to reveal any armature of hooks, even on the suckers. The latter measure 0·17 mm. in diameter; they are sunk somewhat deeply in the substances of the head, and their orifices are flush with the surface.

There is a considerable unsegmented neck following the head. Its width at first is only 0·43 mm., but on passing backwards it becomes rapidly wider. The segments are not distinctly marked off from one another until a point is reached about 3 mm. behind the head. The earliest segments so marked off measure 0·12 mm. in length and 0·8 mm. in width.

Throughout the strobila the segments are considerably wider than their length. The sexually mature segments (Pl. VI. fig. 2) near the middle measure 0·47 mm. in length and 3·5 mm. in width. The measurements become much less disproportional, however, in the gravid segments at the posterior end, which are considerably narrower and at the same time longer.

The number of segments in an entire worm is about 230.

The genital pores are unilateral, being situated in front of the middle of each segment, near its anterior angle, and on what appears to be the left side.

INTERNAL ANATOMY.

Parenchyme and Musculature.—The cortical parenchyme is about equal in thickness to the medullary. It is denser and more closely crowded with large nuclei. The muscles of the body are not strongly developed; there are, apparently, no muscle-fibres running transversely or dorso-ventrally, and the longitudinal fibres, though fairly numerous, do not form a conspicuous layer in transverse section.

Nervous System.—The usual pair of lateral nerve-stems is present; they are rather stout and situated very near to the outer border of the segments. Owing to the imperfect preservation of the nervous system, I am unable to give a fuller account of it.

Excretory System.—The water-vascular system is very interesting, and in some points seems to be unique.

A distinct pair of dorsal excretory vessels is present throughout the strobila. These vessels are of very equal calibre throughout, and do not appear to form any communication along their course, either with each other or with the rest of the vascular system. They lie close to the dorsal limit of the medullary parenchyme, and more towards the middle line of the segments than the lateral nerves; their distance from the nerves is about equal to the distance of the latter from the edges of the segments. The vessels follow a slightly undulating, almost straight course in the mounted specimens which I have examined.

The ventral longitudinal vessels are not present as a distinct pair of canals, but are represented by a complicated system of intercommunicating tubes, of small diameter, ramifying throughout the medullary parenchyme from side to side. This system (Pl. VI. fig. 3) may be said to consist essentially of four main longitudinal vessels, connected at the junction of each segment with its neighbour by a transverse vessel. The tubes are swollen into "nodes" at each of the points where they cross each other. Here and there irregular anastomoses between the vessels occur, a vessel sometimes forking and meeting one of the transverse connecting vessels at two points instead of one.

Genital Organs.—The female organs are the first to appear in the young segments. Rudiments of them are seen very far forward in the neck of the worm, at about 1·2 mm. from the anterior extremity, and before the boundaries of the segments are well marked. The male organs do not make their appearance for some distance behind this point.

The female glands (fig. 2, *Ov.*) are situated in a compact group somewhat to the left or pore side of the segments.

The testes (fig. 2, *T.*) are numerous, and two unequal groups of them can be distinguished, though they form an almost continuous series across the segment. One group, the smaller of the two, lies between the lateral limit of the medullary parenchyme on the left side and the female glands. The larger group extends from the right-hand limit of the medulla, in a somewhat wedge-shaped form, nearly as far as the female glands. The testes in this group are more numerous and more closely crowded towards the edge of the segment than towards the middle. On either side of the segment the testes extend beyond the dorsal excretory vessel. They have an average diameter of 0·0375 mm.

The cirrus-sac (fig. 2, *C.S.*) is small and thin-walled. It measures 0·1 mm. in length and 0·06 mm. in width at the widest part, which is near the inner end. The cirrus appears to be unarmed.

The genital ducts pass ventrally to the dorsal excretory vessel and dorsally to the nerve.

The vas deferens is not thrown into any large coils, but runs a comparatively straight course, with small undulations, inwards from the cirrus-sac and parallel with the vagina. Its outer half only is somewhat closely coiled. Its inner end is obscured by the mass of female glands. I have not detected a vesicula seminalis, nor any network formed by the vasa efferentia, such as is described by Beddard (1912) for *Inermicapsifer* and *Hyracotænia*.

The ovary (figs. 2 & 4, *Ov.*) is a fairly compact, somewhat lobulated organ of crescentic shape, the convexity being anterior. The space between the two backwardly-directed horns is occupied by the compact shell-gland and a small spherical organ (fig. 4, *R S.*), which appears to be at the extremity of the vagina, and which I believe to be the receptaculum seminis, and is closed in behind by the vitelline gland, which lies at a somewhat lower level, towards the ventral side.

The vagina opens at an external pore, quite distinct from that of the cirrus-sac, but immediately behind it. Its outer half has a narrow lumen, and its course is somewhat undulating. The inner half, however, becomes straighter and widens out into a thin-walled, spindle-shaped expansion. It then narrows again before passing over the outer part of the ovary to open into the small rounded organ which I have called the receptaculum seminis. This organ, as described here, appears to be a new structure. If my interpretation of it be correct, it may possibly have been overlooked in the accounts of related species, and the dilated, fusiform, proximal portion of the vagina, which I have mentioned above, may not be, as has been supposed, the true receptaculum seminis *.

The small "receptaculum" is connected with the ovary by a short oviduct, which opens into it below, and is apparently continued immediately, in the same straight line and in a backward direction, to the shell-gland. Ventral to, and extending behind, the latter organ, and connected with it by a short duct, is the large compact vitelline gland (figs. 2 & 4, *V.*).

From the shell-gland, on the dorsal side, a duct passes upwards and forwards, bending round over the anterior edge of the ovary, and then continuing its course below this to the right, across the middle of the segment (fig. 4, *Ut.*). This is the beginning of the uterus, which is visible by reason of the contained ova in segments which are just

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* See Fuhrmann, 1902, fig. 18, *rs.* ("*Zschokkia*" *linstowi*); v. Janicki, 1910, pl. xiii. fig. 17, *R.S.* ("*Inermicapsifer*" *hyracis*). Also Beddard, 1912, p. 607, in the key to the genera. "Receptaculum seminis [in *Zschokkeella* and *Inermicapsifer*] long and forming end of vagina."

becoming gravid (fig. 2, *Ut.*). It occupies the middle field of the segment, extending across it in a transverse direction. In its early stages it appears to be an irregularly branched tube, but soon becomes more distended and like an oblong sac in form. Its boundaries are never very clearly marked, the walls being exceedingly delicate.

The uterus persists through about 28 segments, but after a short time appears to break down altogether, and the ova are seen to be scattered among the parenchyme.

Very soon a number of little thickenings appear, evenly distributed throughout the medullary parenchyme, each being the result of a very active local proliferation of nuclei. Into the middle of each of these thickenings several eggs find their way, and each clump of eggs thus formed becomes surrounded by a more and more definite spherical investment of condensed parenchymatous tissue, which is very opaque owing to the crowded nuclei.

The fully developed egg-capsules measure 0·3 mm. in diameter, and each contains about 20 eggs. The embryos have a diameter of 0·016 mm.; they do not appear to be provided with pyriform bodies. In the fully ripe proglottids at the posterior end of the worm (fig. 5) the egg-capsules occupy almost the entire space within the cortical parenchyme. On opening such a segment with needles, the capsules come away quite freely, leaving rounded spaces separated only by thin walls of tissue, which is all that remains of the medullary parenchyme.

The definitive structure of the egg-capsules (fig. 6) is almost identical with that described and figured by Beddard (1912) for *Inermicapsifer capensis.* There is an outer layer of large cells, the contents of which appear to be finely granular, especially in the outer row of cells. The cells of the inner coat are rather smaller and contain many large globules. Possibly these may be of the nature of nutrient material for the embryos. The eggs, enclosed in their thin membranes, are contained in cavities in the centre of the organ, surrounded by a spongy mass of substance in which I was unable to distinguish cell-boundaries. It contains many globules similar to those seen in the inner cell-layer of the capsule. In all probability, therefore, the central substance is formed by the breaking-down of the innermost cells of this layer. The cavities in which the eggs are lodged become conspicuous in mounted preparations, owing to the shrinkage of the egg-membranes away from them. They apparently have a cellular lining, the nuclei of which can be seen flattened against their walls.

The spherical egg-containing masses thus formed in the interior of the segment are, without doubt, the homologues of the multiple organs described by various authors in more or less nearly related Cestodes, and variously termed "egg-capsules," "Parenchymkapseln," or "paruterine organs" (Beddard, 1912). The manner of their formation, as seen in the present species, appears closely similar to the process described by Beddard (1912) for his species *Inermicapsifer capensis*. There seems to be no ground for supposing that the capsules in which the eggs are enclosed, whether they are to be regarded as "paruterine organs" or not, are derived in any way from the uterus. The evidence afforded by the present species is entirely opposed to such a view. On the contrary, it gives some support to the theory put forward by Beddard (1912) that these egg-capsules are in reality multiple "paruterine organs," not derived from the uterus, but from the medullary parenchyme.

In the paper referred to, Dr. Beddard devotes considerable attention to these organs in *Inermicapsifer*, and seems inclined to regard them as homologous with the similar organs of *Zschokkeella*. He quotes v. Janicki (1910), who describes the eggs in *Zschokkeella* as lying "einzeln in einfache Bindegewebskapseln" (whereas several eggs are said to be included in each capsule in *Inermicapsifer*), and uses the supposed differences between their egg-capsules as a means of separating the two genera. This mark of distinction, the author states, he formerly believed to hold good; but he continues, "I do not, however, feel confident about this point, and in view of other points of likeness between the genera am disposed to compare more nearly the paruterine organs in the two."

While the present species seems to afford evidence in support of this part of Dr. Beddard's views, it may be said, at the same time, that it does not favour the theory suggested in his paper (1914) on *Rhabdometra cylindrica*—that the paruterine organ is not only not the derivative, but actually the forerunner, of the uterus (*loc. cit.* p. 873, and text-fig. 9). In the present case the uterus is well developed long before there is any indication of the thickenings of the parenchyme which are the beginnings of the egg-capsules. When these thickenings appear the uterus simultaneously disappears. Hence there can be—in this species, at all events—no question of its being developed from them.

Note on the Systematic Position of the Species.

At first sight I was inclined to place this form in the genus

Davainea. Finding that it bore a close general resemblance to the two species described as *Davainea polycalceola* and *D. celebensis* by v. Janicki (1901)—two forms which also inhabit species of *Mus*,—I was almost led into the somewhat natural error of placing my species near to them. A closer examination, however, failed to reveal any traces of hooks on the suckers; and since I have carefully examined the scolices of five individuals, having in one case teased up the suckers in glycerine, and still failed to see any hooks, I think it may be assumed that they are normally absent, and that this is not merely a case of their accidental loss. This being so, my specimens could not be referred to *Davainea*.

Having come to this conclusion, and having made reference to Dr. Ransom's very useful key to the genera of Tænioid Cestodes (1909), the only genus there mentioned, I think, to which this form can be assigned is *Zschokkeella*. In some points which I shall mention it diverges slightly from this genus as diagnosed by Ransom (*loc. cit.* p. 65), but it is questionable whether the differences are large enough to warrant the addition of another new genus to the ever-growing list.

The only other genus to which this species makes a near approach is one very closely related to *Zschokkeella*, and which has been described since the compilation of the key referred to, viz. *Inermicapsifer*, v. Janicki. It does, indeed, bear a very close resemblance, not only in general aspect, but in many details, to some of the species described under this name by v. Janicki (1910) and by Bischoff (1912, 1913). But the form to which it seemed nearest, *Inermicapsifer hyracis*, v. Janicki, has been removed by Beddard into the genus *Zschokkeella* (1912, p. 606). Dr. Beddard has also now referred his species *Thysanotænia gambiana* (1911 *a* and *b*) to *Zschokkeella*. This form occurred in the Gambian Pouched Rat (*Cricetomys gambianus*), so that, if my species belongs to that genus, it will be the second occurring in a rodent.

On referring to Dr. Beddard's paper on *Inermicapsifer* and the allied genera (1912), and turning to the useful key given at the end of that paper, I came to the conclusion that my species was considerably nearer to *Zschokkeella* than to *Inermicapsifer* as there diagnosed, if not actually (as I venture to make it provisionally) a member of the former genus.

The special features which these two genera possess in common are:—

(1) An excretory system which forms a capillary network in every segment.

(2) A fusiform swelling on the inner half of the vagina. (This has been interpreted as a receptaculum seminis, but in the foregoing account of my species I have suggested that there is probably such an organ distinct from this.)

(3) A small and weak cirrus-sac.

As far as these features are concerned, my species might be referred to either genus. It differs from *Inermicapsifer* in the following points:—

(1) The genital pores are rather anterior than posterior on the edge of the segment.

(2) There appears to be no vesicula seminalis.

(3) The uterus is fairly well developed before the appearance of egg-capsules.

It may be said to approach *Inermicapsifer* in one of the points mentioned as distinctive (Beddard, 1912), viz., the testes are divisible into two groups; but they so nearly form a complete series across the segment (except where interrupted by the female organs) that it is difficult to say whether their arrangement is more like that seen in *Inermicapsifer* or that in *Zschokkeella*. In this respect the species seems to be intermediate between the two genera.

It resembles the described species of *Zschokkeella* in the following points, besides the general features already mentioned:—

(1) The absence of a vesicula seminalis.

(2) The presence of a fairly well-developed uterus in the segments when they are first becoming gravid.

As already pointed out, the testes are not quite, though very nearly, in a continuous row. In this respect the species shows a slight divergence from the type of *Zschokkeella*. It also differs from it slightly in the position of the genital pores, which are rather anterior to the middle of the edge of the segment. The presence of more than one egg in each egg-capsule does not seem to forbid the inclusion of the species in *Zschokkeella*.

The excretory system differs in its arrangement from that described for the members of either genus. In both *Zschokkeella* and *Inermicapsifer* the usual two distinct pairs of longitudinal vessels, dorsal and ventral, are stated to be present, the ventral vessels being of wider calibre than the dorsal and situated almost in the same horizontal plane with them, but more towards the middle line of the worm. Further, in *Zschokkeella* "a fine capillary network in the periphery of the cortical parenchyma connects all four excretory vessels" (Ransom, 1909, p. 65). In *Inermicapsifer* the main ventral vessels appear to be connected by a capillary network which not only extends throughout the ventral part of the medullary parenchyme, but also penetrates on to the dorsal side. The dorsal longitudinal vessels are not in direct communication, like the ventral vessels, with this system, but, if connected with it at all, are only indirectly so connected (v. Janicki, 1910, p. 394). In *Inermicapsifer hyracis* (which is removed by Dr. Beddard to *Zschokkeella*) there is, according to v. Janicki's account (1910, p. 378), an indirect connection of this kind between the dorsal vessels and the capillary network, and also a very slender vessel running parallel with and external to each main dorsal vessel, and connected with it at frequent intervals by little cross-vessels like the rungs of a ladder (1910, pl. xiii. fig. 16).

Von Janicki's figures of the excretory network in this species do not give the impression of a series of almost regular longitudinal vessels, connected by a single transverse vessel for each segment, as observed in the species which forms the subject of this paper. On the contrary, the vessels composing the network in *Z. hyracis* seem to be much more numerous and irregular.

In my species there is no distinct pair of ventral longitudinal vessels of large diameter. The capillary network, which appears to take their place, extends into the middle of the medullary parenchyme, but the dorsal vessels are situated at the extreme dorsal limit of the latter, and are, I believe, entirely distinct from the network. I have not observed any appearance resembling the ladder-like structure described for *Z. hyracis*, nor even any lateral offshoots whatever from the dorsal vessels.

Taking into consideration all the above-mentioned morphological points, I have decided to place the present species in the genus *Zschokkeella*. It may be defined as follows:—

Zschokkeella muricola, sp. n.

Length 9–12 *cm.* *Breadth* 3·5 *mm.* *Number of segments* 230. *Scolex wider than neck. Segments all broader than long. The excretory system consists of a distinct pair of dorsal longitudinal vessels and a ventral network arranged on a regular plan, with a transverse vessel in each segment. Genital organs begin to appear in the neck before the segments become clearly defined. Genital pores unilateral, on the left side, near the anterior end of the proglottids; not situated on a prominent papilla. No genital cloaca. Testes in two unequal groups, the larger group on the side remote from the genital* *pores. Sperm-duct not greatly coiled. Cirrus-sac small. No vesicula seminalis. A small rounded receptaculum seminis present, in addition to a fusiform expansion of the inner half of the vagina. Uterus a branched tube at first, becoming a transverse sac; not persistent. Many egg-capsules developed in gravid segments, each containing about 20 eggs.*

Hab. Intestines of a rat (probably *Epimys rattus*), Accra, Gold Coast, W. Africa.

Type-specimens in the British Museum (Natural History).

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EXPLANATION OF PLATE VI.

Zschokkeella muricola.

Fig. 1. The scolex, highly magnified.

Fig. 2. Three young sexually mature segments, to show the general arrangement of the organs. (From a stained preparation.)

C.S., cirrus-sac; *D V.*, dorsal excretory vessel; *Ov.*, ovary; *S*, shell-gland; *T.*, testes; *Ut.*, uterus; *V.*, vitelline gland; *Vag*, vagina; *V.D.*, vas deferens.

Fig. 3. Portion of the ventral network of excretory vessels, in five consecutive segments. (Reconstructed from a series of horizontal sections.)

L., longitudinal vessel; *T.*, transverse vessel.

Fig. 4. Diagram of the arrangement of the female organs in a sexually mature segment, as seen from above.

Ov., ovary; *Ovd.*, oviduct; *R.S.*, receptaculum seminis; *S.*, shell-gland; *Ut.*, uterus; *V.*, vitelline gland; *Vag.*, vagina.

Fig. 5. The six hindmost (gravid) segments of an entire specimen, showing the manner in which they are filled with the egg-capsules (*E.C.*).

Fig. 6. Section through a single egg-capsule, highly magnified. *A.*, outer cell-layer; *B.*, inner cell-layer; *C.*, *C.*, cavities in the central substance, in which the embryos are contained; *Emb.*, one of the contained embryos.

All the figures were drawn with the aid of a camera lucida.

V.—*On some Australian* Cicadidæ.

By W. L. Distant.

I recently received from Dr. Hamlyn Harris, Director of the Queensland Museum, Brisbane, a collection of Cicadidæ for identification. Amongst those were some specimens from such interesting localities as Toowoomba and Stradbroke Island belonging to South Queensland. Four new species contained in this consignment I now describe—the types are in the British Museum.

Melampsalta stradbrokensis, sp. n.

♂. Head, pronotum, and mesonotum black; abdomen above testaceous, base and transverse segmental fasciæ, lateral angulate segmental spots, and anal segment black; sternum and legs black; lateral margins of face testaceous; streaks and apices to femora, apices and annulations to tibiæ, and posterior margins to opercula ochraceous; abdomen beneath dark ochraceous, basal margin, apex, and lateral segmental spots black; tegmina and wings hyaline, the first with the interior of costal membrane castaneous; pronotum centrally longitudinally sulcate; mesonotum with a central longitudinal carinated fascia, compressed near middle and ampliated posteriorly; exposed tympana greyish white with transverse fuscous lines; face centrally sulcate for about half its length, not strongly transversely ridged; opercula small, transverse, ochraceous, black at base, not meeting internally, posteriorly broadly rounded.

Long., excl. tegm., 17 mm.; exp. tegm. 42 mm.

Hab. South Queensland; Stradbroke Island (*H. Hacker*). Type Brit. Mus.

To be placed near *M. latorea*, Walk.

Melampsalta geisha, sp. n.

♀. Vertex of head, face, and pronotum castaneous brown, area of the ocelli, margin of front, and a sublateral fascia on each side of face black; clypeus black; mesonotum castaneous brown, with four anterior black obconical spots, the two central spots shortest, a small black spot near each anterior angle of the basal cruciform elevation; abdomen above testaceous, posterior segmental margins flavous, anterior segmental margins black, anal segment with two longitudinal black fasciæ; body beneath and legs testaceous, femora more or less spotted with black; abdomen with a central series of somewhat obscure black spots, the posterior segmental margins flavous; tegmina and wings hyaline, the first with the venation and the costal and postcostal membranes more or less testaceous, wings with the venation piceous brown, apex of anal area infuscated; vertex longitudinally impressed between the ocelli; pronotum with the central area longitudinally grooved; face distinctly centrally sulcate and strongly transversely carinate.

Long., excl. tegm., ♀, 13 mm.; exp. tegm. 37 mm.

Hab. South Queensland; Stradbroke Island (*H. Hacker*). Type Brit. Mus.

Allied to *M. infuscata*, God. & Frogg., who described that species as the then only one of the genus seen "with apex of anal areas of wings infuscated."

Melampsalta hackeri, sp. n.

♂. Body above and beneath ochraceous, with a more or less virescent tint; vertex of head with the area of the ocelli, four prominent spots at anterior margin, the two central spots largest, and a transverse spot near anterior margin of each eye, pronotum with two central linear fasciæ connected anteriorly and posteriorly and the fissures, mesonotum with two anterior central obconical spots, a posterior central elongate spot and a rounded spot in front of each anterior angle of the basal cruciform elevation, and some spots on anterior margin of the metanotum black; on each side of the obconical spots to mesonotum is a small angulate spot and a long submarginal spot of a pale brownish hue; abdomen above with the anterior margin of the basal segment, the interior of the tympanal cavities, a centrally broken series of segmental, discal, transverse fasciæ on the upper surface of abdomen, and a series of lateral segmental spots to same black; face with two central longitudinal black fasciæ and an oblique black spot at base of each antenna; coxal spots, streaks to femora, apices of tibiæ, spines to anterior femora, base and apex of rostrum, and a basal central marginal spot to abdomen black; tegmina and wings hyaline, the first with the venation ochraceous, the extreme costal margin, the postcostal membrane, the upper margin of basal cell, and basal area of inner margin to clavus black; wings with the venation darker on apical area; body above and beneath more or less greyishly pilose; opercula transverse, well separated internally, posterior margins broadly rounded; face longer than broad, distinctly centrally longitudinally sulcate, strongly transversely carinate, the lateral areas depressed.

Long., excl. tegm., ♂, 18 mm.; exp. tegm. 50 mm.

Hab. South Queensland; Stradbroke Island (*H. Hacker*). Type Brit. Mus.

Allied to *M. labyrinthica*, Walk.

Melampsalta toowoombæ, sp. n.

♀. Head, pronotum, and mesonotum black, head with the ocelli red, the front brownish ochraceous, a spot at base between the ocelli, and a smaller spot on the lateral margins ochraceous; face black, the lateral margins and a central spot at base ochraceous; rostrum ochraceous, its apex broadly black; pronotum with a central, discal, longitudinal, ochraceous fascia, the fissures, and anterior and posterior margins dull castaneous; mesonotum with the basal cruciform elevation ochraceous, centrally black; abdomen above ochraceous, a broad central longitudinal fascia, margins of the abdominal segments, and the apical area black, the last with a long angulate ochraceous spot; head beneath and sternum black, abdomen beneath and legs ochraceous; coxæ, trochanters, and femora black or blackish, base and apical area of abdomen beneath black; tegmina and wings hyaline, venation black, costal and postcostal membrane and a basal streak before clavus ochraceous; wings with the base narrowly ochraceous; head foveately impressed between and behind the ocelli; face deeply centrally sulcate; the transverse sulcations profound; wings with six apical areas.

Long., excl. tegm., ♀, 13 mm.; exp. tegm. 42 mm.

Hab. South Queensland; Toowoomba (*Hamlyn-Harris*). Type Brit. Mus.

A species to be placed near *M. murrayensis*, Dist.

SYNONYMICAL NOTES.

In the Proc. Roy. Soc. Victoria (n. s.), 1914, pp. 15–18, pl. iii., Mr. Howard Ashton has described "Three new African Cicadas," all of which are unfortunately old and long-before described species. It is a very speculative proceeding to describe in Australia new species from the Ethiopian Region, especially without the opportunity for comparison with properly identified specimens from that area.

Munza basimacula.

Platypleura basimacula, Walk. List. Hom. i. p. 10 (1850).
Platypleura reducta, Walk. *l. c.* p. 11 (1850).
Munza pygmæa, Jacobi, Sjöstedt, Kilimanj. Exped., Hom. t. i. fig. 3 (1910).
Platypleura sikumba, Asht. Proc. Roy. Soc. Vict. (n. s.) 1914, p. 16, pl. iii. fig. 5.

A very widely distributed species, received from S. and Centr. Africa and from the Congo region.

Platypleura quadraticollis.

Platypleura quadraticollis, Butl. Cist. Entom. i. p. 104 (1874); Dist. Ins. Transvaal, vol. i. p. 172, t. xvii. fig. 9 *a*, *b*, ♀ (1906).
Platypleura nigromaculata, Asht. Proc. Roy. Soc. Vict. (n. s.) 1914, p. 16, pl. iii. fig. 3.

This species is widely distributed. Butler originally described it from Lake N'Gami; I found it in the Transvaal, and we have received it from Uganda; Ashton has redescribed it from a specimen received from Entebbe.

Platypleura divisa.

Cicada divisa, Germ. in Silb. Rev. Ent. ii. p. 80, t. xxiii. (1834).
Platypleura longirostris, Asht. Proc. Roy. Soc. Vict. (n. s.) 1914, p. 17, pl. iii. fig. 4.

Mr. Ashton's figure is quite misleading; it is unnecessarily magnified.

Although Mr. Ashton describes the wings as "reddish yellow," the absence of any coloration in the figure makes the wings appear to be hyaline; he also correctly describes "a white spot on margin just outside anal area" which does not appear in the illustration. The length of the rostrum is not a constant character. It is a common species throughout South and East Africa.

Abricta noctua, Dist. Ann. & Mag. Nat. Hist. (8) xii. p. 487 (1913).

Abricta rufonigera, Asht. Trans. Roy. Soc. S. Austr. xxxviii. p. 349, pl. xvii. fig. 6 (1914).

Kobonga froggatti, Dist. Ann. & Mag. Nat. Hist. (8) xii. p. 490 (1913).

Kobonga castanea, Asht. Trans. Roy. Soc. S. Austr. xxxviii. p. 351, pl. xxxviii. fig. 5 (1914).

VI.—*On new Species of* Histeridæ *and Notices of others.*

By G. Lewis, F.L.S.

It is only within very recent years that anything has been known of the Coleopterous fauna of Formosa. The first paper on the Histeridæ is in the 'Ent. Mitteilungen' in 1913, and enumerates 36 species. Since this a collection has been brought to England by Dr. T. Shiraki, bringing the number, with a few others, up to 76, of which some are of special interest in showing the distribution of several genera and species not hitherto included in the Japanese or Chinese faunas. From Japan 70 species have been recorded, but from China proper scarcely more than 20 are known. The present paper will serve as a report on Dr. Shiraki's collection. The most remarkable species in it is the *Sternaulax*, of which there is a single example only, and which appears to be the New Zealand species; I should like to see this confirmed by the capture of more specimens. The *Teretriosoma* is new and described here, and there is also a new species of *Epiechinus*. The last genus requires a very careful study, and when made the sterna should be figured, as in them the chief specific characters reside. I have four or five unrecorded species from the Oriental Region, and I think it will be better to treat with them in a separate paper.

Teretriosoma formosum, sp. n.

Oblongum, cylindricum, breve, robustum, nigrum nitidum, undique sat dense punctulatum; pronoto angulis anticis rufis; prosterno antice marginato; mesosterno marginato, aliquanto acute prominulo; tibiis anticis 6-dentatis.

L. 2½ mill.

Oblong, cylindrical, robust, black and shining, surface somewhat densely and finely punctulate; the thorax, marginal stria complete, anterior angles distinctly reddish, also the legs and antennæ; the prosternum, anterior edge distinctly marginate; the mesosternum somewhat acute anteriorly and also distinctly marginate; the anterior tibiæ are 6-dentate on the outer edge, with two small teeth at the tarsal end; the pygidium is rugose on the posterior portion in the male.

This species is very similar to *T. somerseti*, Mars., but it is structurally different in the form of the mesosternum and also in its margination. In *somerseti* the edges are simply elevated and the projection obtuse.

Hab. Kotosho, Formosa.

List of Species.

(The names of the localities are attached to those in Dr. T. Shiraki's collection.)

NIPONIIDÆ.

Niponius impressicollis, Lew. Horisha.
—— *canalicollis*, Lew. Kotosho.

HISTERIDÆ.

Trypeticus venator, Lew. Horisha.
—— *sauteri*, Bickh.
—— *canalifrons*, Bickh.
Teretriosoma formosum, sp. n. Kotosho.
Hololepta elongata, Er. Kotosho.
—— *higoniæ*, Lew. Horisha.
—— *depressa*, Lew. Shinten.
—— *indica*, Er.
Plæsius javanus, Er. Kotosho.
Sternaulax zealandica, Mars. Kotosho.
Apobletes tener, Mars.
—— *cerylonoides*, Bickh.
—— *schaumi*, Mars. Koshun.
Platylister cambodjensis, Mars.
—— *atratus*, Er. Formose.
—— *niponensis*, Lew.
—— *horni*, Bickh.
Platysoma schenklingi, Bickh.
—— *lewisi*, Mars. Taipin.
—— *pini*, Lew. Kiirun.
—— *unicum*, Bickh.
—— *cribropygum*, Mars. Kotosho.
—— *confucii*, Mars. Koshun.
—— *celatum*, Lew. Horisha.
—— *sylvestre*, Schm.
Cylistosoma lineicolle, Mars Taipin.
Eblisia sauteri, Bickh.
—— *pygmæa*, Bickh.
—— *pagana*, Lew.
Pachylister lutarius, Er. Koshun.
—— *chinensis*, Mars. Horisha.
—— *congener*, Schm. Horisha.
Merohister jekeli, Mars. Horisha.
Hister thibetanus, Mars. Koshun.
—— *orientalis*, Payk. Horisha.
—— *punctulatus*, Wied. Horisha.
—— *boleti*, Lew. Shinten.
—— *multidens*, Schm.
Peranus depistor, Mars Horisha.
Atholus pirithous, Mars. Shinten.
—— *duodecimstriatus*, Schr. Taipin.
—— *cœlestis*, Mars.
—— *philippinensis*, Mars.
Grammostethus niponensis, Lew. Arisan.
—— *curvicollis*, Bickh.
Epierus sauteri, Bickh.

Parepierus lewisi, Bickh.
Carcinops quatuordecimstriata, Steph. Taipin.
Pachylomalus musculus, Mars. Horisha.
Paromalus niponicus, Lew. Horisha.
—— *oceanitis*, Mars. Kotosho.
—— *mendicus*, Lew. Arisan.
—— *viaticus*, Lew. Taihoku.
—— *vernalis*, Lew. Horisha.
—— *sauteri*, Bickh.
Dendrophilus xavieri, Mars. Taipin.
Tribalus punctillatus, Bickh.
—— *colombius*, Mars.
Cypturus ænescens, Er. Kagi.
Anaglymma circularis, Mars. Kotosho.
Notodoma bullatum, Mars.
—— *formosum*, Bickh.
—— *fungorum*, Lew. Taipin.
Onthophilus ostreatus, Lew. Horisha.
Epiechinus, sp. n. Koshun.
Abræus bonzicus, Mars. Kitosan.
—— *indicus*, Lew.
Anapleus stigmaticus, Schm.
Bacanius niponicus, Lew.
Saprinus speciosus, Er. Taihoku.
—— *optabilis*, Mars. Koshun.
—— *quadriguttatus*, Fabr. Rokkiri.
—— *nitidulus*, Fabr. Taihoku.
—— *varians*, Schm. Koshun.
—— *sinæ*, Mars. Taipin.
Gnathoncus rotundatus, Kugel. Taihoku.

VII.—*Notes on the Asiatic Bamboo-Rats* (Rhizomys, *etc.*).

By OLDFIELD THOMAS.

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IN connection with the determination of a bamboo-rat obtained in Burma during the Bombay Natural History Society's Mammal Survey, I have examined all the specimens of this interesting group in the Museum, and now make some preliminary notes about them, with descriptions of new species.

The genus *Rhizomys*, as hitherto used, is evidently a composite one, and three groups are distinguishable from each other, typified respectively by the species *sinensis*, *sumatrensis*, and *badius*, the first being the type of *Rhizomys* *, the second of *Nyctocleptes*, and the third of a new genus now described. The chief characters of these three genera are as follows :—

---

* Although both *sinensis* and *sumatrensis* were included in the genus *Rhizomys*, when first formed by Gray, the former is fixed as the genotype by the paragraph next before "*Rhizomys*" in the description: "The third genus described was *founded on* a glirine quadruped nearly allied to the Bamboo-Rat [*Mus sumatrensis*] . . . . ."

1. NYCTOCLEPTES, Temm.

Size very large. Palm and sole-pads low, hardly raised above the general surface, granulated, the two posterior sole-pads conjoined. Mammæ 2—3=10.

Anteorbital foramina oval or circular. Posterior nares well open, often nearly as wide as high.

Set of incisors intermediate between that found in the other two genera. M^1 about the size of m^2, not or rarely worn to a lower level.

Range. Burma, Malay Peninsula, and Sumatra.

Type. Nyctocleptes sumatrensis (*Nyctocleptes dekan*, Temm.). Other species *cinereus*, McCl. (including *erythrogenys*, Anders.), and *insularis*, sp. n. (*infrà*).

2. RHIZOMYS, Gray.

Size rather less than in *Nyctocleptes*. Palm and sole-pads distinct, granulated, the two posterior sole-pads separated, though enlarged. Mammæ normally 1—3=8, though occasionally a minute anterior pectoral pair, not functional in any specimen examined, may be present.

Anteorbital foramina subtriangular. Posterior nares contracted, much higher than broad.

Incisors forming a segment of a comparatively small circle, their points directed backwards. M^1 decidedly smaller at all ages than m^2, and worn in adults much below the level of the latter.

Range. Assam, Burma, and Siam to South China.

Type. R. sinensis, Gray. Other species, *vestitus*, M.-Edw., *davidi*, Thos., *pruinosus*, Blyth, *latouchei* and *pannosus*, spp. nn. (*infrà*).

3. CANNOMYS *, gen. nov.

Size comparatively small. Palm and sole-pads normal, well defined, not granulated. Mammæ 2—2=8.

Anteorbital foramina and posterior nares much as in *Rhizomys*.

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* From κάννα, cane or bamboo. While searching for a suitable name for this animal, I have noticed that the term *Myoryctes*, given to a fossil Madagascan rodent by Dr. Forsyth Major (Geol. Mag. (5) v. p. 97, 1908), is preoccupied by Eberth (Zeitschr. Wiss. Zool. xii. p. 530, 1863) (*Myoryktes*, quoted as *Myoryctes* by Scudder, 'Nomenclator,' p. 204, 1882). I would suggest renaming the Malagasy genus *Majoria*, after its distinguished discoverer and describer.

Incisors forming a segment of a large circle, their points thrown strongly forwards. Molars decreasing in size backwards, the first decidedly larger than the second, its grinding-surface not worn lower than that of the latter.

Range. Nepal to Southern Siam, not extending into China.

Type. Cannomys badius (*Rhizomys badius*, Hodgs.). Other species *castaneus*, Blyth, and *minor*, Gray.

Descriptions of new species:—

Nyctocleptes insularis, sp. n.

General characters as in *N. sumatrensis*, but size markedly smaller; two adult male skulls measure 75 and 76 mm. in condylo-basal length, and two females 71 mm., while in the Malaccan form these measurements are at least 81 and 78 respectively, and often much more. Crests less developed throughout in specimens of corresponding age, and, as a consequence, the occipital plane is distinctly lower.

Colour very light, though some specimens of the mainland form are similar. Flanks and shoulders whitish; an ill-defined darker line down crown and nape, and the posterior back darker. One specimen in four with a slight tendency to the reddening of the cheeks often found in *sumatrensis*, and still more marked in the more northern *cinereus*.

External dimensions of a male in spirit:—

Head and body 320 mm.; tail 130; hind foot 57·5; ear 17.

Skull-dimensions of male and female, the second the type: condylo-basal length 76, 71; condylo-incisive length 77, 72·5; zygomatic breadth 56, 52; nasals 26·7 × 11, 23 × 11; breadth across frontals anteriorly 21·2, 23·5; intertemporal breadth 12, 12·5; height of crown from alveolus of m^3 27·7, 27; occipital plane, height from basion 25, 24 breadth 33·5, 33·5; palatal foramina 7, 6·6; width of posterior nares 5·4, 6; upper molar series (crowns) 14·2, 13·5.

Hab. Deli, Sumatra. Type from Padang Brahrang.

Type. Adult female. B.M. no. 99. 8. 21. 5. Collected and presented by Theo. C. Barclay, Esq. Four specimens examined.

Whatever Hardwicke's meaning was in attaching the name *sumatrensis* to an animal which he only knew from a drawing of a Malaccan specimen, it is quite clear that there is no escape from the use of that term for the peninsular form, and now that the Sumatran representative of the genus proves to be different it must have another name.

The three forms *N. cinereus*, *sumatrensis*, and *insularis* form a series decreasing in size southwards with a gradual lightening of colour and disappearance of the red on the cheeks. Whether they will prove to be sharply separable from each other, or intergrade, there is as yet not enough material to decide.

Rhizomys latouchei, sp. n.

Size slightly greater than in *R. sinensis* and *pruinosus*. Fur soft; hairs of back about 20 mm. in length. Colour of the most pronounced "*pruinosus*" character, dark smoky grey profusely grizzled with the white ends to the longer hairs. Under surface rather paler. Top of muzzle darker. Area round mouth greyish white. Hands and feet brown, fingers whiter. Tail blackish, apparently without lighter tip. Mammæ, functional, 1—3=8, but there is in addition a minute anterior pectoral pair which have obviously never been used.

Skull heavily built, more so than in *sinensis* and *pruinosus*. Nasals evenly narrowing backwards. Antorbital foramina rounded, less triangular than in the other *Rhizomys*, and more resembling those of *Nyctocleptes*. Interorbital region broad, its edges square, slightly converging backwards, continuous with the parietal ridges; the latter remain separate throughout, at least 5 mm. apart, and do not form a median sagittal crest. Occipital plane comparatively low, more nearly vertical than in other species. Breadth of posterior narial opening about half its height.

Molars rather light. M^1 distinctly worn down below the line of m^2.

Dimensions of the type:—

(No external measurements available.)

Skull: condylo-basal length 69 mm.; condylo-incisive length 67·5; zygomatic breadth 50; mesial height of zygoma 9; nasals 26×9; anteorbital foramen 5·1×5; greatest breadth on frontals 19·5; interorbital breadth 13·2; height of crown from alveolus of m^3 27; occipital plane, height from basion 21·5, breadth 32; palatal foramina 7·3; upper molar series (crowns) 13·5.

Hab. Swatow, Quangtung, China. "In hills."

Type. Adult female. B.M. no. 92. 2. 1. 27. Collected February 1889, and presented by J. de La Touche, Esq.

While the skin of this species is indistinguishable from that of *R. pruinosus*, the skull has some resemblance to that of *Nyctocleptes* by its thick build, rounded antorbital foramina, and broad unconstricted interorbital region.

From its locality it might have been supposed to be

R. sinensis, which has not been rediscovered since its capture near Canton by Reeves nearly 90 years ago; but the skull differs in too many important characters for this to be the case. The anteorbital foramina, the non-development of a sagittal crest or intertemporal waist, the height of the zygomatic bone, and the slant of the occipital plane are all so different that the identity of the two is quite impossible.

I have named this fine animal in honour of its donor, to whom the National Collection is indebted for so many valuable Chinese mammals.

Rhizomys pannosus, sp. n.

R. pruinosus group. Mammæ 1—3=8.

Size about as in *R. sinensis*. Fur thin, poor, and rather harsh. General colour near "Verona brown," varying towards greyish brown; the long hairs, as in *pruinosus*, brown with white ends, but, owing to their lesser number, there is not the strong hoary effect present in that species. Under surface sparsely haired, almost naked, its thin covering greyish brown. Head rather darker than back. Hands and feet nearly naked, greyish brown. Tail naked, blackish. Mammæ 1—3=8: this number quite clear and definite in two adult females.

Skull short, stout, very heavily built, the crown higher and more convex above than in *pruinosus*. Occipital plane not so strongly slanted as in the latter. Sagittal crest developed the whole length of the parietals in the male, but in the female the muscular ridges do not meet except on the posterior third of the parietals, the space between them anteriorly about 4 mm. in breadth. Nasals slightly exceeding the premaxillary processes behind. Anteorbital foramina subtriangular, neither so rounded as in *Nyctocleptes* nor so angular as in *vestitus* and its allies. Zygomata very high mesially. Posterior narial opening medium, neither so open as in *sumatrensis* nor so contracted as in *vestitus*. Incisors not thrown forwards, about as in *pruinosus*. Molars rather narrower and lighter than in *pruinosus*, the difference especially perceptible in youth. First upper molar smaller and worn lower than the second.

Dimensions of the type (measured on the skin):—

Head and body 320 mm.; tail 120; hind foot (wet) 46.

Skull: condylo-basal length 64·2; condylo-incisive length 64; zygomatic breadth 47; nasals 25×9·5; anteorbital foramen 6·8×5; breadth between outer corners of the two foramina 23; mesial height of zygoma 9; intertemporal breadth 10·5; height of crown from alveolus of m^3 28·5; occipital plane, height from basion 22·5, breadth 30·7;

palatal foramina 7·5; width of posterior nares 4; upper molar series (crowns) 12·5.

Another, older, female skull has an approximate condylobasal length of 69 mm., with intertemporal diameter 12 mm.

Hab. Chantabun, S. Siam.

Type. Adult female. B.M. no. 7. 1. 1. 163. Collected by M. Henri Mouhot. Tomes Collection. Three adult and two young specimens, all collected by Mouhot.

This species is distinguishable from its allies, the other members of the *pruinosus* group, by its thin fur, browner colour, and the height and convexity of its brain-case.

VIII.—*On Bats of the Genus* Promops.

By Oldfield Thomas.

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The genus *Promops*, as restricted by Miller *, contained at the time the latter wrote only two species—*P. nasutus*, Spix, from the Rio São Francisco, Brazil, and *P. fosteri*, Thos., from Paraguay. When describing *P. fosteri*, I took as representing *P. nasutus* the large species so named by Dobson, but Mr. Miller has suggested to me that it is the Paraguayan bat which is the real *nasutus*, and that I should have described the larger form as new.

Since that time a certain amount of additional material has come into the Museum, and I have now examined it with a view to clearing up the confusion on the subject.

The most important specimen is one collected by A. Robert in 1903 at Lamarão, Bahia, a locality so near the Rio São Francisco that the specimen, which agrees sufficiently closely with Peters's description and figure of Spix's type, may be taken as representing the real *Promops nasutus*.

Peters's measurements of the skull are a little inconsistent *inter se*, so that some must be erroneous, but the majority of them, and the excellent figure, agree nearly with Mr. Robert's specimen, which is, as Mr. Miller suggested, a comparatively small form, widely different from the *Molossus nasutus* of Dobson, but yet not quite the same as *P. fosteri*.

A study of the whole series indicates that six forms of *Promops* may be distinguished, two large ones from opposite ends of the range of the genus and four small ones from Brazil, Paraguay, and Argentina. They are mostly distinguished by size, so that, taking an exact measurement of the two first molars on their outer edge as a gauge, the species may be arranged as follows :—*

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* "Families and Genera of Bats," U.S. Nat. Mus. Bulletin 57, p. 259 (1907).

A. First two molars 4·0 mm. and upwards.
  a. 4·4–4·5 mm. (Central America.) .... 1. *centralis.*
  b. 4·0–4·1 mm. (Paraguay.) .... 2. *occultus.*
B. First two molars less than 3·9 mm.
  a. Forearm about 46–48 mm.
    a'. Two molars 3·6–3·7 mm. Brain-case swollen. (Paraguay.) .... 3. *fosteri.*
    b'. 3·4–3·5 mm. Brain-case less swollen.
      a^2. Colour darker and richer. (Brazil.) ...... 4. *nasutus.*
      b^2. Colour pale and dull. (N. Argentina.) .. 5. *ancilla.*
  b. Forearm 43 mm. (Amazonia.) .... 6. *pamana.*

1. *Promops centralis*, sp. n.

Size largest of the genus. Colour dark rich blackish brown; bases of hairs more prominently white than in the next species.

Forearm of type 54 mm.; metacarpal of third finger 56 mm.

Skull: greatest length from occiput to base of incisors 20·2; condyle to front of canine 19·3; maxillary tooth-row 8·3; m^1 and m^2 on outer edge 4·5.

Hab. N. Yucatan, Central America.

Type. Adult female. B.M. no. 94. 2. 5. 4. Collected by G. F. Gaumer. Presented by Osbert Salvin, Esq. Three specimens.

2. *Promops occultus*, sp. n.

Slightly smaller than *P. centralis*, the skull hardly smaller, though there is propoitionally more difference in the teeth. Colour rather less rich brown, and with less white at the bases of the hairs.

Forearm of type 51 mm.; third metacarpal 54·5.

Skull: greatest length 20; condyle to front of canine 18·8; maxillary tooth-row 7·9; m^1 and m^2 on outer edge 4·0.

Hab. Paraguay. Type from Sapucay.

Type. Adult female. B.M. no. 2. 4. 11. 24. Original number 714. Collected 6th March, 1902, by W. Foster. Two skins and two spirit-specimens.

The great difference between this and the other Paraguayan species, *P. fosteri*, had not been previously noted owing to the fact that, the Museum being well supplied with specimens of *P. fosteri*, the skulls were left in the spirit-specimens, and the skins were made into duplicates and have only now had their skulls cleaned,

3. *Promops fosteri*, Thos.

Size markedly smaller than in the two previous species. Brain-case unusually swollen, much more so than in *P. nasutus*.

Forearm of type 48·5 mm.; third metacarpal 50.

Skull: greatest length 18·5; condyle to front of canine 17; maxillary tooth-row 6·8; m^1 and m^2 on outer edge 3·7.

Hab. Paraguay. Type from Villa Rica.

Type. B.M. no. 1. 8. 1. 17.

4. *Promops nasutus*, Spix.

Size rather smaller than in *P. fosteri*, the brain-case much less swollen. Colour similarly dark and rich.

Forearm of type, measured by Peters, 47·5; upper tooth-row 7·3.

Bahian specimen:—Forearm 48·5, third metacarpal 50.

Skull: greatest length 17·6; condyle to front of canine 16·2; maxillary tooth-row 6·7; m^1 and m^2 on outer edge 3·5.

Hab. E. Brazil. Type from Rio São Francisco.

Type in Munich Museum.

5. *Promops ancilla*, sp. n.

Size and cranial characters as in *P. nasutus*. Hairs of body not or scarcely passing on to interfemoral membrane. Colour paler and more drabby brown—upper surface rather paler than "mummy-brown"; under surface similar, but still paler, the white bases to the hairs well marked and prominent, the long hairs of the flank and axillary region nearly wholly white.

Dimensions of the type:—

Forearm 50 mm.; third metacarpal 53·7.

Skull: greatest length 17·5; condyle to front of canine 16·4; maxillary tooth-row 6·8; m^1 and m^2 on outer edge 3·4.

Hab. N. Argentine. Type from Cachi, Salta. Alt. 2500 m.; a specimen from Tucuman.

Type. Adult male. B.M. no. 6. 5. 8. 4. Collected 15th April, 1905, by J. Steinbach. Three specimens.

I should have been inclined to call this bat, which was first obtained by Sr. Dinelli in 1902, a subspecies of *P. nasutus*, but, as the Paraguayan *P. fosteri* comes between the ranges of the two, we must await further material before presuming that intermediate specimens occur.

6. *Promops pamana*, Miller.

Forearm only 43 mm. in length. Third metacarpal 44·5.

Hab. Upper Purus River, Amazonia. Type from Hyntanaham.

Type in U.S. National Museum, No. 105528.

Described on a specimen without skull.

IX.—*Descriptions of Two new Lizards from Australia.*
By G. A. BOULENGER, F.R.S.

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AMONG the reptiles collected by Dr. R. Scharff on his visit to Australia with the British Association and submitted to me for identification, I have found examples of two unknown Scincid lizards, which are here described. Dr. Scharff has kindly allowed me to keep the types for the British Museum.

Lygosoma scharffi.

Section *Siaphos.* Habit lacertiform; the distance between the end of the snout and the fore limb is contained once and a half in the distance between axilla and groin; fore limb tetradactyle, hind limb pentadactyle. Snout short, rather pointed. Lower eyelid with an undivided transparent disk. Nostril pierced in the nasal; no supranasal; frontonasal nearly as long as broad, forming a broad suture with the rostral; no præfrontals; frontal slightly longer than the frontoparietals, in contact with the first and second supraoculars; four supraoculars, first smallest; seven supraciliaries; frontoparietals distinct, longer than interparietal; parietals forming a suture behind the interparietal; a pair of nuchals and a pair of temporals border the parietals; fourth upper labial below the centre of the eye. Ear-opening minute. 20 smooth scales round the middle of the body, dorsals largest. Præanals feebly enlarged. Fore limb reaching between the ear and the eye; fingers short, third slightly longer than second; hind limb nearly as long as the distance between the end of the snout and the fore limb; toes short, third and fourth equal, with 14 or 15 smooth lamellæ inferiorly. Dark brown above, with lighter dots, brownish white beneath; a blackish lateral streak on the posterior part of the body and on the tail; brown spots on the lower lip.

	mm.
Total length	57
Head	7
Width of head	4
Body	23
Fore limb	7
Hind limb	10
Tail (reproduced)	27

A single specimen from One Tree Hill, near Brisbane.

This very distinct species is easily distinguished by the number of digits, all other Australasian and Malayan species of the section *Siaphos* having either five or three digits to both limbs. Among the African species* the digits are either 5+5 all well developed, 5+5 with the pollex rudimentary or clawless, 4+4, or 4+3. This is the first-discovered species with digits 4+5.

Both this and the following lizard are good examples of the fallacy, from the point of view of natural relationships, of basing genera on the number of digits in the family Scincidæ.

Lygosoma peronii, var. *tridactylum*.

Body much elongate; limbs very weak, tridactyle; the distance between the end of the snout and the fore limb is contained twice to twice and one-third in the distance between axilla and groin. Snout short, obtuse. Lower eyelid with an undivided transparent disk. Nostril pierced in the nasal; no supranasal; frontonasal broader than long, forming a suture with the rostral and with the frontal; latter shield as long as the frontoparietals, as large as or a little smaller than the interparietal, in contact with the first and second supraoculars; four supraoculars, second largest; seven supraciliaries; parietals forming a suture behind the interparietal; three pairs of nuchals; fifth upper labial below the centre of the eye, from which it is separated by a series of suboculars. Ear covered with scales, indicated by a depression. 18 or 20 smooth scales round the middle of the body, dorsals largest. A pair of enlarged præanals. The length of the hind limb equals the distance between the centre of the eye and the fore limb; third toe considerably longer than second. Tail thick, nearly once and a half the length of head and body. Bronzy brown above, most of the scales with a dark brown dot; a black dorso-lateral line; sides grey, speckled with black; lower parts whitish, spotted with black.

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* *Cf.* Boulenger, Tr. Zool. Soc. xix. 1909, p. 243.

	mm.
Total length	110
Head	8
Width of head	5
Body	102
Fore limb	8
Hind limb	12
Tail	65

Three specimens obtained at Yallingup, S.W. Australia.

The above description is almost an exact reproduction of that of *L. peronii* *, except for the absence of the fourth digit—a character which is common to the three specimens collected at Yallingup. As, however, among a large number of typical *L. peronii* from the Coolgardie district, W. Australia, presented by Mr. L. C. Webster, I find one with four fingers and three toes, I think it preferable to describe the tridactyle form as a variety or subspecies rather than as a species.

This interesting lizard adds a link to the chain of closely allied forms of the section *Hemiergis*:—

Lygosoma initiale, Werner.	Digits 5 + 5.
—— *peronii*, Fitz.	„ 4 + 4 (rarely 4 + 3).
—— ——, var. *tridactylum*.	„ 3 + 3.
—— *decresiense*, Fitz.	„ 3 + 3.
—— *quadrilineatum*, D. & B.	„ 2 + 2.

X.—*On the African Shrews belonging to the Genus* Crocidura.—III.

By Guy Dollman.

[Continued from vol. xv p. 575.]

Group C (*zaphiri* and *olivieri*).

Size large. Colour above slaty brown or pale umber. Third upper unicuspids broader than second.

(23) *Crocidura zaphiri*, sp. n.

A dull, slaty, cinnamon-coloured species, with small upper unicuspids and a very bristly tail.

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* Dr. Werner has proposed the name *L. quadridigitatum* to replace that of *L. peronii*, Fitz., on the assumption that Fitzinger's name is more recent than that of *L. peronii*, D. & B. But it is the reverse, and the latter species should bear the name *L. blackmanni*, De Vis, if both are placed in the same genus.

Size of body rather less than in *nyansæ*, more as in *olivieri*. Fur fairly long, hairs on back 6–6·5 mm. in length.

Colour above dull cinnamon-brown mixed with dark slate-grey, the new pelage about as in "deep mouse-grey" mixed with "fuscous," and the worn coat "Prout's brown" washed with "Saccardo's umber." Flanks rather more slaty, the transition to the slate-grey of the ventral surface gradual and indistinct. Belly dark slate washed with greyish buff ("deep neutral grey" washed with "light greyish olive"), darker than in *nyansæ* or *olivieri*. Backs of hands and feet dirty buff. Tail shorter than in *nyansæ*, brown above, a trifle paler below; bristle-hairs exceptionally numerous and long, from 14 to 17 mm. in length, and densely distributed throughout nearly the entire length of the tail, greyish in colour.

Skull with narrow maxillary region; teeth smaller than in *nyansæ, olivieri*, or *doriana*, about as in *flavescens*. Upper unicuspids small, especially the second, which appears considerably smaller than the third when viewed from above; last upper molar broad.

Dimensions of the type (measured in the flesh):—

Head and body 105 mm.; tail 60; hind foot 18·5; ear 11.

Skull (broken): length of palate 11·9; least interorbital breadth 4·6; greatest maxillary breadth 7·7; length of upper tooth-row 12·3.

Hab. Charada Forest, Kaffa, Abyssinia.

Type. Adult female. B.M. no. 6. 11. 1. 12. Original number 100. Collected on June 2nd, 1905, by Mr. Zaphiro, and presented to the British Museum by W. N. McMillan, Esq.

The chief diagnostic characters of this species are the dull slaty-brown colouring, the great development of the caudal bristle-hairs, and the small size of the second upper unicuspids. *Crocidura macrodon*, Dobs., which is supposed to have come from the Sudan, is a very much smaller animal, the hind foot being only 14 mm. in length.

(24) *Crocidura olivieri*, Less.

Sorex olivieri, Lesson, Man. Mamm. p. 121 (1827).

A pale coffee-brown-coloured species allied to *zaphiri*.

About equal in size to *flavescens*, rather smaller than in the *nyansæ* group. Fur of back fairly short, hairs from 5 to 6 mm. in length.

General colour of upper parts considerably paler than in *zaphiri*, near "Saccardo's umber" mixed with "Prout's brown," the brownish tint changing on the lower flanks rather abruptly into the greyish white of the belly; ventral surface "light greyish olive," paler than in *nyansæ* or *zaphiri*, almost as pale as in *doriana*, but more silvery. Lateral gland white. Backs of hands and feet brownish. Tail dark brownish above and below, bristle-hairs long and fairly numerous, evenly distributed over the basal two-thirds.

Skull smaller and narrower than that of *nyansæ*. Teeth like those of *zaphiri*, third upper unicuspid larger in transverse section than the second. Basal cusp of anterior upper incisors quite small, as in *zaphiri*, *doriana*, and the *nyansæ* group.

Dimensions of five specimens from Giza, Egypt (two measured in the flesh and the others preserved in spirit):—

	Head and body. mm	Tail. mm.	Hind foot. mm.	Ear. mm.
♂. Giza	106	69	20	10
♀. "	110	65	18	10
♂. "	106	70	19	12
♀. "	94	64	19	10 5
♀. "	93	63	17·5	10·4

Skulls:—

	♂. mm.	♂. mm.	♀. mm.	♀. mm.	♀. mm.	♀. mm.
Condylo-incisive length	28 5	29	28	28	28	27 3
Greatest breadth	11·8	11 8	12	11·9	11·8	11 2
Least interorbital breadth ..	5 5	5·3	5	5·3	5	5
Length of palate	12·7	12·7	12 1	11·9	12·5	12
Postpalatal length	12	12 5	11·7	12·2	12·1	11 5
Greatest maxillary breadth ..	8 9	9·2	8 9	8 9	8 9	8 8
Median depth of brain-case ..	6·7	6·4	6·3	6·2	6·2	6 3
Length of upper tooth-row ..	13·1	12 9	12 7	12·5	12 1*	12 5

Hab. Egypt.

The much paler and yellower colour and less hairy tail immediately distinguish this Egyptian shrew from the Abyssinian *zaphiri*.

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* Tips of incisors worn off.

Group 7 (*beiræ* and *hirta*).

Size medium to fairly small. Colour above dull coffee-brown, bright reddish buff, greyish buff, or dull chocolate; ventral surface light grey, rather distinctly marked off from the brownish flanks. Second and third upper unicuspids about equal in size.

(25) *Crocidura beiræ*, sp. n.

Intermediate in size between *flavescens* and *hirta*.

Colour rather duller than in *flavescens*, above dark coffee-brown ("sepia" mottled with "neutral grey"), a shade darker than in the new unbleached coat of *flavescens*; the worn pelage is not markedly different, rather longer and paler in colour (near "raw umber"), not nearly so bright in tint as in *hirta* or *flavescens*. Flanks rather greyer than back, the brown colour passing fairly abruptly into the pale grey of the ventral surface. Belly darker than in *flavescens*, in the new pelage "smoke-grey," more buffy in the older phase, near "buffy brown." Backs of hands and feet dirty white or brownish. Tail long, rather more finely haired than in either *flavescens* or *hirta*, dark blackish brown above, brownish buff below; bristle-hairs fairly numerous, white in colour.

Skull markedly smaller than that of *flavescens*, but larger than in *hirta*. Interorbital region rather narrow and more parallel-sided. Teeth like those of *flavescens* in general shape, but much smaller.

Dimensions of the type and three topotypes (measured in the flesh):—

	Head and body. mm	Tail. mm.	Hind foot. mm.	Ear. mm.
♂ (type). Beira....	103	55	16	10·5
♂. "	106	62	15	11
♂. "	107	55	16	11
♂. " . .	97	50	15·5	10

Skulls of type and three topotypes:—

	♂ (type). mm.	♂. mm.	♂. mm.	♂. mm.
Condylo-incisive length	25·3	24·5	25·3	25
Greatest breadth	10 7	10 6	10·7	10 6
Least interorbital breadth	4·6	4·8	4·6	4 8
Length of palate	10·5	10·2	10 6	10 5
Postpalatal length	11·2	10 9	11	11
Greatest maxillary breadth	7·8	7·9	7·9	7·9
Median depth of brain-case	6·8	6·7	6·7	6 8
Length of upper tooth-row	10 9	10·6	11	10 9

Hab. Beira, Portuguese East Africa.

Type. Adult male. B.M. no. 7. 6. 2. 28. Original number 1747. Collected on December 19th, 1906, by Mr. C. H. B. Grant, and presented to the British Museum by C. D. Rudd, Esq.

Its smaller size and duller colouring distinguish this Beira species from the South-African *flavescens*; the Tette form, *hirta*, is considerably brighter and lighter in colour and smaller in size.

(26) *Crocidura beiræ nyikæ*, subsp. n.

Related to the Beira species, darker in colour and with a rather longer brain-case.

Size of body about as in *beiræ*.

Colour of dorsal surface dark brown ("blackish brown (1)" mixed with "mummy-brown"), about as in the *fumosa* group, considerably darker than in *beiræ*. Flanks similar in colour to back, the tint fading rather gradually into the dark brownish grey of the belly; underparts much darker and browner. Backs of hands and feet dark brown. Tail dark brown above and below, not lighter on the lower side; bristle-hairs fairly numerous, greyish brown in colour.

Skull like that of *beiræ*, but with a rather longer and more flattened brain-case; tooth-row a trifle shorter.

Dimensions of type (taken from dry skin) and two topotypes (in spirit):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♀ (type)	89	50	16	9
♂	93	52	16	11
♂	95	47	14·5	11

Skulls of type and two topotypes:—

	♀ (type). mm.	♂. mm.	♂. mm.
Condylo-incisive length..........	24·3	24·9	25·1
Greatest breadth	10·3	10·7	10·5
Least interorbital breadth	4·9	4·7	4·8
Length of palate............	9·9	9·9	10·1
Postpalatal length	10·9	11·3	11·2
Greatest maxillary breadth	7·7	8·2	7·8
Median depth of brain-case	5·8	6·2	6
Length of upper tooth-row	10·6	10·6	10·7

Hab. Nyika Plateau, North Nyasaland. Altitude 6000-7000 feet.

Type. Adult female. B.M. no. 97. 10. 1. 50. Collected in July 1896 by Mr. A. Whyte, and presented to the National Collection by Sir Harry Johnston.

The much darker colour of the back, belly, and extremities, and dark ventral surface of the tail, and longer brain-case distinguish this Nyika form from the Beira shrew.

(27) *Crocidura hirta*, Pet.

Crocidura hirta, Peters, Reis. Mossamb., Saug. p. 78, pl. xviii. fig. 2 (1852).

Crocidura canescens, Peters, Reis. Mossamb., Saug. p. 83, pl. xviii. fig. 4 (1852).

Crocidura annellata, Peters, Reis. Mossamb., Saug. p. 85, pl. xviii. fig. 5 (1852).

A medium-sized cinnamon-brown species.

Size smaller than in *flavescens* or *beiræ*.

Colour, in unbleached state, pale slaty grey overlaid with wavy rufous markings ("mouse-grey" washed with "snuff-brown" and "drab"). In the worn pelage the colour is much redder, the grey of the hair bases being completely hidden and the general colour bright yellowish brown ("russet"). The tint changes on the flanks rather abruptly into the greyish white of the ventral surface. In the unbleached and immature pelage the transition is much more gradual, the ventral surface being considerably darker and more slaty, the creamy-white hair-tips not so dominant as in the worn coat. Lateral gland white. Backs of hands and feet dirty white or brownish. Tail of medium length and rather coarsely haired, brown above, paler below; bristle-hairs fairly numerous, evenly distributed over basal two-thirds, whitish in colour.

Skull smaller than that of *beiræ*, with flatter and narrower brain-case and smaller teeth; second and third upper unicuspids about equal in size.

Dimensions (as given by Peters):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Length of skull. mm.	Greatest breadth. mm.
♂	85	55	15	22·5	10
♀	82	50	14	21	9·25
♀	75	45	14	21·75	9·5

Hab. Tette, Portuguese East Africa.

In the British Museum there is a very large series of specimens from various localities which would appear to represent this species. The colour-change exhibited by these specimens is very remarkable, and for the present I am forced to conclude that *hirta*, *canescens*, and *annellata* are simply colour-phases of a single form. The immature grey coat, in which no rufous tint is present, is that described and figured for *canescens*. The gradual appearance of the rufous colouring, due to the bleaching of the hair-tips, gives the coat the same general appearance as is described and figured for *annellata*. Further bleaching results in the lengthening of the reddish hair-tips and complete concealment of the slaty colour of the hair-bases, combined with a gradual lightening of the underparts, contrasting more strongly with the rufous-tinted flanks than in either the grey phase or the condition described as "*annellata*." The dimensions given by Peters for *canescens* and *annellata* are as follows:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Length of skull. mm.	Greatest breadth. mm.
canescens	80	46	13·5	21	9
annellata ♂ ..	83	52	15	23	9·5
" ♂ ..	90	55	14	22	9·5
" ♀ ..	72	45	14	22	9 5

The following are the flesh-dimensions of seven specimens in the Museum Collection:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♀. Tette	87	48	15
♂. Salisbury	90	49	14
♀. "	80	43	13
♀. "	82	47	14
♀. E. Loangwa	75	46	13·5
♂. Katanga...........	90	53	15
♂. Angola	90	44	15

Skull-dimensions:—

	♀. Tette. mm.	♂. Mazoe. mm.	♀. Loangwa. mm.	♂. Angola. mm.
Condylo-incisive length	21·7	22·8	22·5	23·7
Greatest breadth	9·6	9·8	9·5	10
Least interorbital breadth	4·5	4·8	4·3	4·5
Length of palate.......	8·8	9·6	9·4	9·8
Postpalatal length	9·3	9·9	10	10·2
Greatest maxillary breadth ..	6·7	7·5	7·2	7·5
Median depth of brain-case ..	5·3	6·3	5	5·5
Length of upper tooth-row ..	9·3	10	9·6	10·3

This species would appear to have a very wide distribution; in the Museum Collection are specimens from the following localities:—Tette, Salisbury, Mazoe, S. Nyasa, Loangwa, Katanga, and Angola.

(28). *Crocidura hirta flavidula*, Thos. & Schw.

Crocidura flavescens flavidula, Thomas & Schwann, P. Z. S. p. 264 (1905).

In dimensions agreeing closely with *hirta*.

Colour above (in worn pelage) more uniform than in the Tette species, the grey speckling not so dominant, general colour of back "Prout's brown" mixed with "cinnamon-brown." Flanks, ventral surface, extremities, and tail as in *hirta*.

Skull rather larger than in the specimens described by Peters.

Dimensions of the type and four topotypes (measured in the flesh):—

		Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂ (type).	Umvolosi	102	51	14·5	10
♂.	"	92	48	13	9
♀.	"	97	49	13	9
♀.	"	90	50	12·5	9·7
♀.	"	93	48	14	8

Skull of type and two topotypes:—

	♂ (type). mm.	♂. mm.	♀. mm.
Condylo-incisive length	23·5	23	23
Greatest breadth	10	9·8	9·6
Least interorbital breadth	4·6	4·6	4·7
Length of palate	9·8	9·4	9·7
Postpalatal length	10·6	10·1	10
Greatest maxillary breadth	7·4	7·3	7·2
Length of upper tooth-row	9·8	10·1	10

Hab. Umvolosi, Zululand.

Type. Adult male, B.M. no. 4. 12. 8. 29.

This Zululand shrew would appear to be very closely related to the Tette species, and it seems best to regard it as a race of that form rather than of the much larger and very much more distinct *flavescens*.

(29) *Crocidura hirta pondoensis*, Roberts.

Crocidura pondoensis, Roberts, Ann. Trans. Mus. vol. iv. pt. 2, p. 71 (1913).

Closely allied to *h. flavidula*.

Size about as in *hirta*; tail a little longer than in *h. flavidula*.

Colour described as the same as in *flavescens* (=*cinnamomea*).

Dimensions of the type (as given by Roberts):—

Head and body 78 mm.; tail 59; hind foot 13; ear 10.

Skull: condylo-incisive length 22; basal length 19; greatest breadth 9·5; length of upper tooth-row 9·3.

The range of variation in size is given as follows:—

Head and body 68–84 mm.; tail 51–59; hind foot 13–14; condylo-incisive length 20·6–22·1; greatest breadth 8·9–9·6; upper tooth-row 9–9·6.

Hab. Ngqueleni District, Pondoland.

Type. Male. Transvaal Mus. no. M. 901.

(30) *Crocidura sacralis*, Pet.

Crocidura sacralis, Peters, Reis. Mossamb., Säug. p. 82, pl. xviii. fig. 3 (1852).

A rather small species, with short, fairly thick tail.

Size of body about as in *butleri*.

Colour of upper parts pale brownish buff, rather paler on the flanks, the tint gradually passing into the greyish white of the ventral surface. Backs of hands and feet whitish. Tail short, thick at base, dirty brown above, greyish white below.

Skull smaller than that of *hirta*, about as in *smithi*. Teeth much as in *hirta*, but third upper unicuspid rather smaller than second.

Dimensions of the type (as given by Peters):—

Head and body 70 mm.; tail 37; hind foot 13; ear 7.

Skull: length 21; greatest breadth 8·5.

Hab. Cabaceira Peninsula, Mozambique.

Type. In Berlin Museum.

(31) *Crocidura mariquensis*, Smith.

Sorex mariquensis, Smith, Ill. Zool. S. Afr. i. pl. xliv. fig. 1 (1849).

Size about as in *hirta*, but with smaller skull and teeth.

Colour described as "brownish red, the head and tail lightest, the throat, breast, and belly the same colour, only lighter and with a distinct tint of pearly grey." Smith's co-types, which are preserved in the British Museum, are so faded as to make it impossible to add to this brief description to any extent. The ventral surface appears to have been darker than in *hirta*, and merges very imperceptibly into the brownish tint of the flanks. Backs of hands and feet brownish. Tail brownish above, paler below; bristle-hairs apparently about as in *hirta*. The coloured figure given by Smith is quite unlike either his description or the co-types now before me; it is evident that either some radical change has taken place in the pigment used or else the artist has painted some entirely different animal; the dimensions are those of *mariquensis*, but the colouring is more like what is found in the genus *Neomys*.

Skull smaller than that of *hirta*, with narrower muzzle and smaller teeth; small upper unicuspids about equal in size.

Dimensions of adult co-type (45. 7. 3. 37):—

Head and body 84·6 mm.; tail 48; hind foot 15.

Skull (occipital region broken): length from front of upper incisors to junction of sagittal and lambdoidal sutures 19·2; greatest breadth 9·4; least interorbital 4; length of palate 8; greatest maxillary breadth 6·1; median depth of brain-case 5·5; length of upper tooth-row 8·6.

Hab. "Wood near the Tropic of Capricorn," South Africa.

Co-types. B.M. nos. 45. 7. 3. 37 and 45. 7. 3. 60.

The affinities of this species are extremely difficult to decide, the co-types being in such a bad state of preservation that it is almost impossible to come to any conclusion regarding the general colour or exact dimensions. For the present it seems most convenient to regard it as related to the *hirta* group.

(32) *Crocidura hindei*, Thos.

Crocidura hindei, Thomas, Ann. & Mag. Nat. Hist. (7) vol. xiv. p. 237 (1904).

Allied to *hirta*, but distinguished by its larger skull and teeth.

Size of body much as in *hirta*.

Colour of dorsal surface bright reddish fawn (near "russet" mixed with "Prout's brown"), the fawn tint passing rather abruptly into the light greyish white of the underparts. Backs of hands and feet white. Tail brownish above, white below; bristle-hairs numerous. The immature pelage of this species would appear to be considerably greyer than in the adult stage, as is the case in *hirta*, the reddish tint only appearing as the hair-tips become bleached.

Skull rather larger than that of *hirta*, with larger teeth; upper unicuspids broad, with well-developed cingula, which project beyond the external alveolar border, second and third upper unicuspids about equal in size.

Dimensions of the type (from dry skin):—

Head and body (stretched) 95 mm.; tail 50; hind foot 14.

Skull: condylo-incisive length 24·5; greatest breadth 24·3; least interorbital breadth 4·4; length of palate 10; post-palatal length 11; greatest maxillary breadth 7·8; depth of brain-case 5·8; length of upper tooth-row 10·6.

Hab. Machakos, British East Africa.

Type. Adult female. B.M. no. 1. 8. 7. 2.

This species is undoubtedly closely related to the *hirta* group, agreeing with it in general colouring, but possessing a larger and heavier skull.

(33) *Crocidura hindei diana*, subsp. n.

A pale brownish-buff form related to *hindei*, but with narrower unicuspids.

Size about as in *hindei*.

Colour of upper parts (in worn pelage) very pale brownish buff (near "wood-brown"), the grey hair-bases not nearly so dominant as in *hindei*. Underparts rather whiter. Extremities and tail quite as in the East-African species.

Skull similar in shape; upper unicuspids narrower, the cingula not projecting out beyond the external alveolar border.

Dimensions of the type (measured in the flesh):—

Head and body 86 mm.; tail 48; hind foot 14; ear 7.

Skull (occipital region broken): length from front of incisors to junction of sagittal and lambdoidal sutures 22·3; greatest breadth 10·3; least interorbital breadth 4·5; length of palate 10; greatest maxillary breadth 7·3; median depth of brain-case 4·9; length of upper tooth-row 10·4.

Hab. Lake Chad.

Type. Adult female. B.M. no. 7. 7. 8. 50. Original number 11. Collected by the late Captain Boyd Alexander during the Alexander-Gosling Expedition.

The narrower unicuspids and paler colour separate this form from *hindei*, *hirta*, and the allied races.

1(34) *Crocidura sericea*, Sund.

Sorex sericeus, Sundevall, Vet.-Ak. Handl. Stock. pp. 173 & 177 (1842).
Crocidura strauchii, Dobson, Ann. & Mag. Nat. Hist. p. 225 (1890).

Allied to the *hirta* and *hindei* groups, general dimensions rather larger.

Colour very variable, the usual bleached pelage grey washed with cinnamon-brown, the general effect as in "snuff-brown" speckled with "neutral grey." In some cases where the bleaching process has been carried still further the grey tint is much less conspicuous, the colour between "snuff-brown" and "cinnamon-brown." Underparts pale greyish white, the transition from the reddish brown to the light grey rather sudden. Backs of hands and feet dirty white or buff. Lateral gland white-haired. Tail brownish above, white below; bristle-hairs very long and conspicuous, evenly distributed over nearly the entire length of the tail.

Skull with a rather larger brain-case than in *hindei*; teeth about equal in size, small upper unicuspids narrower, more oval in transverse section, and of equal size.

Dimensions of the type (as given by Sundevall):—

Head and body 90 mm.; tail 49; hind foot 14.

Skull: length 22; interorbital breadth 4·5.

The following are the dimensions of a series in the Museum Collection (measured in the flesh):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♂. Bahr-el-Ghazal	94	55	15
♂. "	90	60	15
♀. "	90	60	15
—. Fashoda	105	65	15
♂. Lake No, Sudan	87	62	15
♀. " "	82	53	15

Skull-dimensions :—

	♀. Lake No. mm.	♂. Bahr-el-Ghazal. mm.	♂. Bahr-el-Ghazal. mm.	♀. Bahr-el-Ghazal. mm.
Condylo-incisive length ..	25	25	24·5	24·8
Greatest breadth	10·7	10·6	10·7	10·4
Least interorbital breadth.	4·5	4·5	5	4·8
Length of palate	10·3	10·4	9·8	10
Postpalatal length	11	11	10·9	11
Greatest maxillary breadth.	7·5	7·8	7·8	7·7
Median depth of brain-case.	5·5	5·5	5·5	5·5
Length of upper tooth-row.	10·8	10·8	10·5	10·7

Hab. Near Bahr-el-Abiad.

(35) *Crocidura beta*, sp. n.

Darker than *hindei*, with a considerably smaller and narrower skull.

Size of body given as about in the Machakos form, hind foot smaller.

Colour of upper parts dull chocolate-brown (near "sepia") mottled with greyish buff, the brownish tint gradually fading on the flanks and passing rather imperceptibly into the greyish white of the ventral surface. Belly rather strongly tinged with yellow, a condition probably due to some secretion of the lateral glands, which are marked by a streak of short white hairs. Backs of hands and feet dirty buff. Tail darker above than in *hindei*, as dark as the general colour of the back, below white; bristle-hairs numerous, white in colour.

Skull considerably smaller, with narrower and rather flatter brain-case. Teeth all a little smaller, second and third unicuspids less circular in transverse section, more triangular, and crushed closely together.

Dimensions of the type (measured in the flesh) :—

Head and body 85 mm.; tail 45; hind foot 12·5; ear 12·5.

Skull: condylo-incisive length 22·8; greatest breadth 9·7; least interorbital breadth 4·3; length of palate 9·5; postpalatal length 10; greatest maxillary breadth 7·5; median depth of brain-case 5·1; length of upper tooth-row 10.

Hab. Charnia River, British East Africa.

Type. Adult male. B.M. no. 12. 7. 1. 67. Original number 10. Collected on December 23rd, 1910, by

A. Blayney Percival, Esq., and presented by him to the British Museum.

The much darker and duller colouring and smaller-sized skull separate this shrew from the Machakos *hindei*.

(36) *Crocidura velutina*, Thos.

Crocidura velutina, Thomas, Ann. & Mag. Nat. Hist. (7) vol. xiv. p. 237 (1904).

Size rather smaller than in *hindei*, but considerably larger than *hildegardeæ*. Fur quite short, the hairs on the back 2·5–3·5 mm. in length. Colour above dull coffee-brown (between "mummy-brown" and "Prout's brown"), the hairs almost entirely brown, only the extreme basal portions slate-coloured. Brown tint on flanks passing fairly abruptly into the silver-grey of the ventral surface, but line of demarcation less marked than in *hindei*; belly rather greyer, less white. Backs of hands and feet dirty white. Tail brown above, a trifle paler below, not sharply as bicoloured as in *hindei*; bristle-hairs short and slender.

Skull in general shape very like that of *hindei*. Teeth about equal in size, the second upper unicuspid appearing rather smaller in transverse section than the third.

Dimensions of the type (measured from dry skin):—

Head and body 83 mm.; tail 47; hind foot 14.

Skull (occipital region broken): length of palate 9·8; greatest breadth 9; greatest maxillary breadth 7·4; length of upper tooth-row 10·1.

Hab. Usambara, German East Africa.

Type. Adult. B.M. no. 99.6.25.1.

The chief characters which serve to distinguish this shrew from *hindei* are its duller colour, darker extremities and tail, and the rather smaller size of the second upper unicuspids.

(37) *Crocidura lutrella*, Hell.

Crocidura lutrella, Heller, Smith. Misc. Coll. vol. lvi. no. 15, p. 4 (1910).

Smaller than *velutina*, with dorsal and ventral surfaces sharply contrasted.

Colour of upper parts described as "light broccoli-brown, this colour descending on the sides unchanged." Underparts "from level of mouth and underside of tail light greyish buff," in marked contrast to the darker dorsal surface. Feet whitish. Lateral glands white. Tail covered by scattered long white hairs throughout its whole length.

Skull about equal in length to that of *jacksoni*.

Dimensions of the type (as given by Heller):—

Head and body 80 mm.; tail 40; hind foot 12.

Skull: condylo-incisive length 21; greatest breadth 9·3; length of upper tooth-row 9.

Hab. Rhino Camp, Lado Enclave.

Type. Adult male. U.S. Nat. Mus. no. 164640.

The smaller dimensions at once distinguish this shrew from *hindei* and its allies, while its light underparts, distinctly marked off from the darker dorsal colouring, render it quite distinct from the *jacksoni* group.

[To be continued.]

XI.—*On the Entomostraca of the Albert Nyanza.*

By William A. Cunnington, M.A., Ph.D.

The scientific exploration of the great lakes of Central Africa has never been undertaken systematically; therefore it is hardly a matter for surprise that in some cases we still know relatively little of the smaller and more obscure forms of life which no doubt exist in them. In consequence of the very exceptional nature of the fauna of Tanganyika, no less than three British Expeditions (the most recent of which I had the honour to conduct) have been sent to investigate that lake. Though Tanganyika was, of course, the first consideration, a good deal of attention was paid to other lakes, particularly Nyasa and Victoria Nyanza, while Prof. Moore, on his second expedition, visited Kivu, Edward Nyanza, and Albert Nyanza in addition. It is, however, the fact that Albert Nyanza has received comparatively little attention, and it therefore becomes the more desirable to place on record any additional information concerning it.

In order to get a knowledge of the plankton organisms, it is clearly necessary to secure a series of tow-nettings, and, as far as I am aware, this had never been attempted for Lake Albert until the summer of 1907. In July of that year a small quantity of material was obtained by my friend Dr. R. T. Leiper, Helminthologist to the London School of Tropical Medicine, who was accompanying an expedition despatched to Uganda by the Egyptian Survey Department. After collecting two samples, one from the surface and the other from near the bottom in about 30 feet of water, Dr. Leiper was unfortunate enough to lose his nets, and thereby his opportunity for further work in this direction. These tow-nettings were taken at the north end of Lake Albert opposite Magungo. On his return home, Dr. Leiper kindly handed over to me his two tubes of plankton, with a view to their examination.

Certain of the groups of organisms thus collected have already been reported on by experts, notably the Algæ by Prof. G. S. West (Journ. Bot. vol. xlvii. 1909, p. 244) and the Rotifera by Mr. C. F. Rousselet (Proc. Zool. Soc. 1910, p. 797), but no account has been given as yet of the Entomostraca.

In March 1908 the German Central Africa Expedition, under the leadership of the Duke of Mecklenburg, visited Lake Albert and made considerable collections, including, of course, samples of the plankton. Although the scientific results of this expedition are still in course of publication, the sections dealing with the Cladocera and Copepoda have already appeared, and naturally treat of forms taken for the most part by the tow-net.

The collections of Ostracoda and Copepoda which I made in Tanganyika, Nyasa, and Victoria Nyanza were very fully reported on by Prof. G. O. Sars; therefore it was to him that I sent Dr. Leiper's Albert Nyanza material, and I am very grateful for the trouble he has taken in examining it. On comparing the list of forms identified by Prof. Sars with that given by van Douwe in his report on the Copepoda of the German Expedition (Wiss. Ergebnisse d. D. Zentral-Afrika Exp. 1907–1908, Bd. iii. 1912, p. 492), I was surprised to find that the former contained twice as many species of Copepoda, in spite of the paucity of material. Prof. Sars's list also records the occurrence in the lake of a species of Ostracod, which thus renders its publication additionally important.

It will, perhaps, be worth while to examine the few records of Entomostraca from the lake, and then to give a complete list of the forms which are at present known to occur. The three species of Copepods described by van Douwe (*op. cit.*) are as follows :—

Cyclops leuckarti, Claus *.
—— *oithonoides*, Sars.
Ergasilus kandti, sp. n.

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* Van Douwe cites this species on p. 489 as *C. leuckarti*, Sars, which is obviously an oversight. He refers to it quite correctly in a more recent paper on the Copepoda of the Second German Central Africa Expedition.

It is necessary to explain that the form referred to as *Cyclops oithonoides*, Sars, is in all probability not that species, which was originally described from Europe, but another which is widely distributed in Africa. On this point I have consulted Prof. Sars, than whom there could be no more competent authority, and I must express my indebtedness to him for writing to me about the matter at some length. As important questions of synonymy are involved, perhaps I may be permitted to quote from his letter. He says:—"The occurrence in Africa of the true *C. oithonoides*, G. O. Sars, has not yet been ascertained. What is so named by van Douwe and other authors is not that species, but either *C. hyalinus*, Rehberg (= *C. crassus*, Fischer), or *C. neglectus*, G. O. Sars, probably the latter species. The only place in Africa where I have noted the former species is from the neighbourhood of Cape Town. These two species are very similar as to the outward appearance, though easily distinguishable by the relative length of the innermost caudal seta, which in *C. hyalinus* is about as long as the outer medial one, whereas in *C. neglectus* it is scarcely more than half its length. Both these species are quite certainly specifically distinct from *C. oithonoides*, which is of a much more slender form of body." (Compare also Sars, Proc. Zool. Soc. 1909, p. 51.)

In one of the tow-nettings collected by Dr. Leiper I found very unexpectedly a young Argulid, so that a representative of this quite distinct group of parasitic Copepoda is to be included among the Entomostraca of the lake. The specimen is probably a male larval form of *Argulus africanus*, Thiele. It has already been referred to in my report on the Branchiura of the Third Tanganyika Expedition (Proc. Zool. Soc. 1913, p. 279).

The only record of Cladocera, so far as I am aware, is that given by Brehm in his account of the Cladocera of the Duke of Mecklenburg's first expedition (Wiss. Ergebnisse d. D. Zentral-Afrika Exp. 1907–1908, Bd. iii. 1912, p. 167). From the tow-nettings taken in Lake Albert he obtained a single species of Daphnid, which he has described (p. 169) under the name of *Daphne* * *monacha*, sp. n. It is a form belonging to the *magna* group. The Cladocera contained in Dr. Leiper's material I had intended to work out myself, but, as I have not been able to do so yet, the species just noticed must remain as the only representative of the group now known from the lake.

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* I cannot agree that it is necessary to reject the name *Daphnia*, which is almost universally applied to this genus. In a later paper on the Cladocera of the Second German Central Africa Expedition, Brehm himself refers to the genus as *Daphnia*.

Proceeding now to combine these records with the list of forms identified by Prof. Sars from Dr. Leiper's material, a complete list of the Entomostraca which are at present known to occur in the Albert Nyanza will be obtained.

Complete List of Entomostraca known from Albert Nyanza.

(The letters in brackets which follow the author citation refer to the collections from which the forms in question have been obtained, namely:—L. = material collected by Dr. Leiper; S. = material collected by Dr. Schubotz during the German Central Africa Expedition, 1907–1908.)

CLADOCERA.

Daphnia monacha, Brehm (S.).

OSTRACODA.

Paracypria obtusa, G. O. Sars (L.).

COPEPODA.

EUCOPEPODA.

Diaptomus galeboides, G. O. Sars (L.).
Cyclops leuckarti, Claus (S., L.).
—— *neglectus*, G. O. Sars (S., L.).
—— *agiloides*, G. O. Sars (L.).
—— *angustus*, G. O. Sars (L.).
—— *varicans*, G. O. Sars (L.).
Ergasilus kandti, van Douwe (S.).

BRANCHIURA.

Argulus africanus, Thiele (L.).

It will be seen that in all only ten species have hitherto been taken in Lake Albert. This is a small number when it is remembered that the lake in question has a superficial area of some 2000 square miles, and there is every reason to believe that it will be greatly increased when the lake has been adequately explored from the biological standpoint.

XII.—*Descriptions of a new* Modiola *from Ceylon and of a new* Tellina *from New Caledonia.* By H. B. PRESTON, F.Z.S.

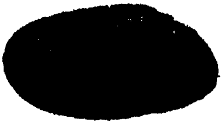
Modiola taprobanensis, sp. n.

Shell inflated, irregularly trapezoidal, somewhat curved, polished, shining, covered with a dark olive-green periostracum, which becomes paler posteriorly and is rather wrinkled towards the anterior ventral region; both valves marked with irregular concentric growth-lines, angularly swollen anteriorly; umbones much eroded; dorsal margin straight; ventral margin curved, slightly gaping in the middle; anterior side sharply rounded; posterior side sloping, obliquely rounded below; interior of shell nacreous, polished, bluish grey anteriorly, brownish bronze posteriorly.

Long. 8·5, lat. 18 mm.

Hab. Ceylon.

Modiola taprobanensis.



Tellina viator.

Tellina viator, sp. n.

Shell thin, elongately ovate, bright pink, concentrically striate, the striæ becoming much coarser anteriorly; dorsal margin almost straight; ventral margin scarcely rounded; anterior side abruptly rounded; posterior side sloping above, somewhat rostrate below.

Long. 8, lat. 15 mm.

Hab. Noumea, New Caledonia.

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XIII.—*A Trematode from* Protopterus.

By H. A. Baylis, B.A.

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Through the kindness of Mr. G. A. K. Marshall, of the Imperial Bureau of Entomology, an opportunity has recently been afforded me of studying a very interesting little Trematode parasite from the intestines of an African mud-fish (*Protopterus æthiopicus*). A considerable number of specimens of the worm were obtained by Dr. G. D. H. Carpenter at Lake Victoria, Uganda.

The species, which I believe to be new to science, possesses not only a borrowed interest on account of the much-discussed position of its host in the animal kingdom, and the fact that its parasites have not (so far as I am aware) hitherto been explored, but also considerable intrinsic interest on account of certain structural peculiarities and its probable systematic relationships.

It is much to be regretted that the material was imperfectly fixed and rather macerated, rendering the cutting of satisfactory sections difficult, so that some of the details of the anatomy must remain for the present doubtful. The main features, however, have not been difficult to make out, and in collecting the data for the following description I have relied as far as possible upon specimens either temporarily cleared and mounted in creosote or stained and mounted whole in balsam. The various series of sections that have been cut have proved useful mainly in confirming conclusions at which I had previously arrived from the examination of the whole preparations.

Heterorchis crumenifer, gen. et sp. n.*

EXTERNAL FEATURES.

The contour of the animal, as seen from above or below, is oval, tapering slightly towards either end. Anteriorly the body is flattened, but posteriorly the ventral side is much swollen by the development of the uterus, so that the body is more cylindrical in this region. The total length of the animal (without pressure) is about 3 mm., and its maximum width, under the same conditions, 1 mm.

The exterior of the body is armed with small, flattened scales, semicircular in outline; they occur on the oral and ventral suckers and on the anterior part of the body, both dorsally and ventrally, extending backwards for a short distance behind the ventral sucker. Somewhat larger scales also occur along the sides of the body for about three-quarters of its length. The posterior end of the body is without scales, and in some of the older individuals many of the scales on the more anterior parts appear to have fallen off, leaving almost the entire body smooth.

The oral sucker measures 0·38 to 0·46 mm. in diameter, and has a small opening. The ventral sucker is larger, having a diameter of 0·55–0·72 mm., and has a wide aperture. On an average, obtained from the measurements of nine individuals, the ratio of the diameter of the oral to that of the ventral sucker is nearly as 2 : 3. The ventral sucker is situated almost entirely within the anterior third of the body, its distance from the oral sucker being only about 0·4 mm.

The genital aperture is situated anteriorly and ventrally, almost on the extreme left side of the body; it is about equidistant from the oral and ventral suckers. The cirrus is sometimes seen protruded from the aperture.

On the dorsal side of the body there is a structure which is the most remarkable feature of the species. At a short distance from the posterior end there is a very large circular or transversely elliptical aperture, extending sometimes almost completely across the body from side to side, in specimens which have not been flattened by pressure. This opening leads forward into a spacious sac or pouch. The latter does not interfere at all with the natural contour of the body externally, but its aperture is very easily seen, and it is not difficult under a dissecting-microscope to insert a fine needle into it and to see that it passes forward without resistance into the sac. This large opening appears to be the aperture of the excretory apparatus, the terminal portion of which is probably represented by the sac.

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* A generic diagnosis is given on p. 95.

INTERNAL ANATOMY.

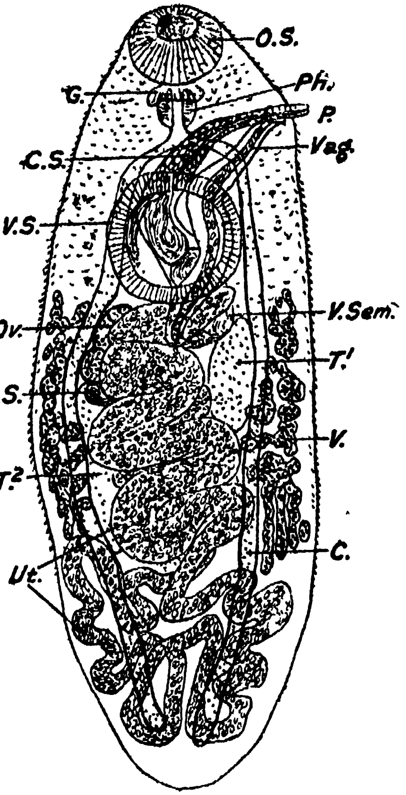
Alimentary Canal.—The oral sucker leads into a very short prepharynx, surrounded by a cluster of "salivary" glands. This is immediately followed by the almost spherical muscular pharynx, 0·18 mm. in length, and this again by a quite short œsophagus, dividing at once into two widely divergent intestinal cæca. The latter are unbranched, and extend nearly as far as the posterior end of the body and considerably beyond the yolk-glands, maintaining about the same width throughout.

Genital Organs.—As already observed, the genital pore is situated very far towards the left side of the body, and at some distance in front of the ventral sucker. It leads into a small common "atrium," at the base of which, side by side, are the openings of the cirrus-sac and vagina. The cirrus-sac is large and muscular, the muscles being arranged longitudinally. It takes a dorsal direction at first from its opening, then curves ventrally and over to the left side, ending behind or slightly to the left of the posterior edge of the ventral sucker. It contains a long eversible penis, which is apparently unarmed. The distal portion of the cirrus-sac is lined with large, conspicuous, and deeply staining "prostatic" cells, which extend back to the level of the ventral sucker. The inner end contains a voluminous vesicula seminalis, divided by a constriction into a larger proximal and a smaller distal portion. The latter has a well-developed coat of circular muscle-bands. Immediately in front of it there is a small oval "pars prostatica."

The two testes are unequal in size and asymmetrical in position. Both are elongate and sausage-shaped, with entire margins, but the right testis is almost twice as long as the left, the measurements being about 0·85 mm. and 0·5 mm. respectively. The anterior end of the right testis is in close contact with the ovary, and it extends backwards nearly as far as the posterior limit of the vitelline glands on that side. The left testis is situated somewhat further forward, beginning nearly at the same level as the ovary and close to the inner end of the cirrus-sac.

The ovary is somewhat lobate and lies on the right side, close to and just behind the ventral sucker. It measures

Fig. 1.

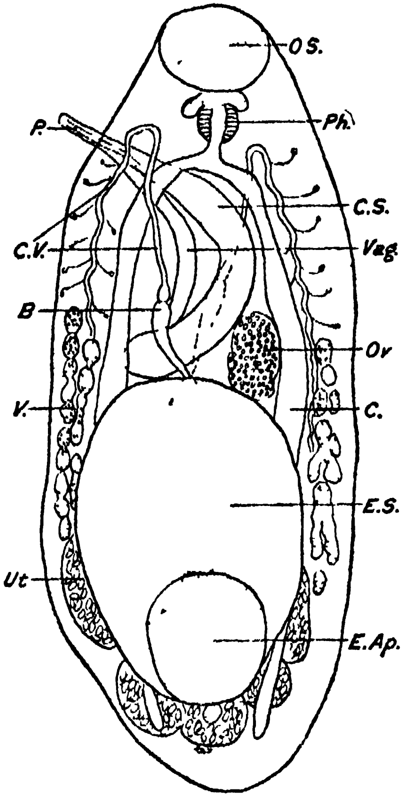


Heterorchis crumenifer.

Ventral view of the entire animal, × 34. *C.*, intestinal cæcum; *C.S.*, cirrus-sac; *G.*, salivary glands; *O.S.*, oral sucker; *Ov.*, ovary; *P.*, cirrus; *Ph.*, pharynx; *R.S.*, receptaculum seminis; $T.^1$, left testis; $T.^2$, right testis; *Ut.*, uterus; *V.*, vitelline glands; *Vag.*, vagina; *V.S.*, ventral sucker; *V.Sem.*, vesicula seminalis.

about 0·35 mm. antero-posteriorly and 0·2 mm. transversely. Just behind the ovary there is a transversely elongated receptaculum seminis, lying somewhat obliquely and below the anterior end of the right testis. Lying to the inner side of the ovary, and partly surrounding the receptaculum seminis, is the cluster of cells composing the shell-gland.

Fig. 2.



Heterorchis crumenifer.

Dorsal view of the entire animal (diagrammatic), to show the dorsal excretory sac, etc. *B*, "bladder" of excretory vessel of left side (the dotted portions of the corresponding vessel and bladder on the right side are partly conjectural); *C.*, intestinal cæcum; *C.S*, cirrus-sac, *C.V*, collecting excretory vessel of left side; *E.Ap.*, aperture of excretory sac; *E.S.*, excretory sac; *O.S.*, oral sucker; *Ov.*, ovary; *P.*, cirrus; *Ph.*, pharynx; *Ut.*, uterus; *V.*, vitelline glands; *Vag.*, vagina.

The vitelline glands consist of somewhat large and irregular lobes, arranged along the sides of the animal from about the level of the hinder edge of the ventral sucker

Fig. 3.

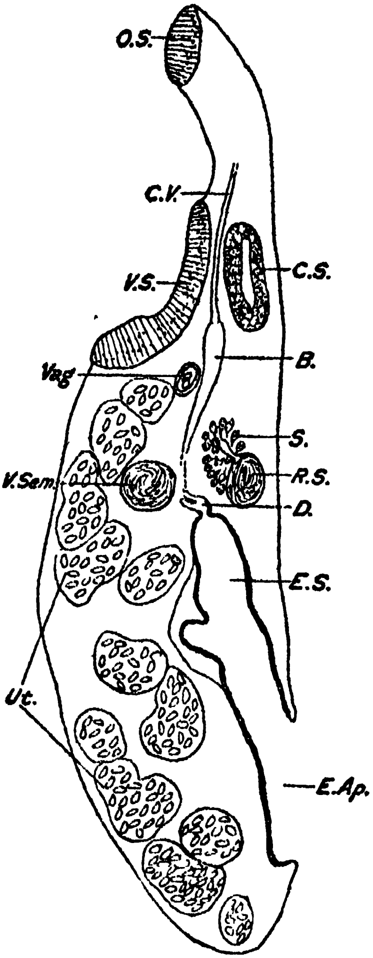
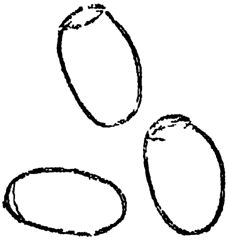


Fig. 4.



Heterorchis crumenifer.

Fig. 3.—Sagittal section, slightly to the right of the middle line (partly diagrammatic) *B.*, "bladder" of excretory vessel; *C.S.*, cirrus-sac; *C.V.*, collecting excretory vessel; *D.*, diverticulum of excretory sac; *E.Ap.*, aperture of excretory sac; *E.S.*, cavity of excretory sac (on the ventral side of the sac part of its epithelium has become separated from the basement-membrane); *O.S.*, oral sucker; *R.S.*, receptaculum seminis; *S.*, shell-gland; *Ut.*, uterus; *Vag.*, vagina, *V.S.*, ventral sucker; *V.Sem.*, vesicula seminalis.

Fig. 4.—Outline drawing of three eggs, highly magnified. In two of them the operculum is partly separated from the rest of the shell.

backwards for about a third of the length of the body. They are situated almost entirely externally to the gut-branch on either side. The two vitelline ducts cross the body just behind the ovary, on the dorsal side, forming a straight line with one another. Owing to the obscurity caused by the excessive development of the uterus at this level, the precise relationships of the complex of organs and ducts belonging to the female apparatus have not been worked out, and the presence of Laurer's canal remains uncertain.

The uterus is very well developed and voluminous in most of the specimens. Passing backwards from its origin behind the ventral sucker, it forms a double sinuous loop in the hinder end of the body. It then turns forward and runs, still with a very sinuous course, up the middle of the body. In this region it becomes much swollen, giving the animal a very prominent contour on the ventral side, and is densely packed with eggs. Finally, it opens into a thick-walled vagina, which begins at the level of the hinder edge of the ventral sucker, and runs forward with a curve almost parallel to the cirrus-sac, with which it is about equal in length. The vagina has a strong coat of circular muscles. The fully formed eggs contained in the uterus are oval, and have a moderately thick brownish shell, with a distinct cap at one end, which is easily separated by slight pressure on the cover-glass. The eggs measure 0·04 mm. in length and 0·02 mm. in breadth. In a very young specimen, in which there were as yet few eggs in the uterus, they were found to have precisely the same dimensions as in the mature individuals.

Excretory Organs.—The excretory system presents in this species an apparently unique condition. The presence of a very large and peculiar sac, with a comparatively enormous aperture, on the dorsal side, has already been mentioned. This sac appears to be lined with a special epithelium, consisting of a single layer of rather tall cells. Unfortunately, owing to the poor fixation of the material, I am unable to describe the nature of this epithelium more precisely, or to decide whether it is ciliated or not. At all events, it is clear that the sac is not merely lined with a continuation of the external cuticle of the animal. The cavity of the sac is usually filled with a mass of loose matter, which may be a product of excretion or may be of mucous nature.

At its anterior end the sac gives off a small ventral diverticulum, into which, apparently (though not directly), the two main collecting vessels of the excretory system empty their contents. I have experienced great difficulty in seeing clearly the termination of both of these tubes in the same preparation, owing to the manner in which they are obscured by the other organs. The diagram (fig. 2) shows in a schematic manner their probable relation to each other and to the dorsal sac. The proximal end of each tube appears to open into a small, elongate, bladder-like organ, which communicates with the diverticulum of the sac. Each tube runs forward to about the level of the hinder end of the pharynx, then doubles immediately backwards to run down the side of the body with a sinuous course, giving off frequent fine branches which end in flame-cells scattered among the parenchyme. The tubes are finally lost among the vitelline glands on either side. The "bladder" and collecting vessel of the left side lie dorsally to the cirrus-sac, vagina, and intestinal cæcum, while the apparatus of the right side appears to pass ventrally below these structures.

NOTE ON THE AFFINITIES OF THE SPECIES.

On a general consideration of its structural characters this form seems to approach most closely to the Trematodes of the family Lepodermatidæ. Among the important features of this family (Odhner, 1911, p. 22) are the following:—

The skin is armed with scales or spines, which generally occur all over the body. The oral and ventral suckers are moderately close together. The alimentary canal consists of prepharynx, pharynx, œsophagus, and two simple intestinal branches. The excretory vesicle is Y-shaped, the division into the two arms of the Y occurring just behind the shell-gland and associated organs. The genital pore is situated typically at a short distance in front of the ventral sucker, but more or less to the left of the middle line. [In *Renifer* and *Ochetosoma* this displacement is very marked, and the pore is nearly at the edge of the body; it is also situated far to the left in *Lechriorchis*.] The cirrus-sac is usually curved in a crescentic manner from its opening to its inner end, is provided with conspicuous longitudinal muscles, and has an internal seminal vesicle, a pars prostatica, and an eversible cirrus. The ovary is on the right side, behind the ventral sucker. The left testis is usually somewhat in front of the right. A receptaculum seminis may or may not be present. The vitelline glands are at the sides of the body in the middle region. The eggs are from 0·02 to 0·05 mm. in length.

In almost all the particulars enumerated above the present species agrees, as will be seen from the foregoing description. The only points in which it is exceptional are the unequal size of the testes and the condition of the excretory system, with the peculiar dorsal sac and wide aperture. In these respects, however, it appears to differ from any other known group of Trematodes as much as from the Lepodermatidæ. Taking into consideration, therefore, its general agreement with the members of this family, I am inclined to the view that it should be included here and regarded as a specialized form, whose peculiarities seem to require the creation of a new genus. The genera to which it appears to be most closely allied are *Ochetosoma*, Braun (1901, 1902), *Renifer*, Pratt (1903), and *Lechriorchis*, Stafford (1905; redefined by Nicoll, 1911). To all of these genera it bears a very close resemblance in most of its morphological features, among which the displacement of the genital pore towards the left side is especially important; but it differs from all of them alike in the shape and unequal size of the testes, in the presence of a well-developed receptaculum seminis, and in the unique condition of the excretory apparatus. In all the three genera mentioned the testes are equal in size, more or less lobate, and not elongate, while the excretory vesicle has the usual shape of a Y, already mentioned as characteristic of the Lepodermatidæ. In *Renifer ellipticus* and *R. elongatus*, Pratt (1903), the stem of the vesicle widens considerably in the middle, and the same seems to be the case in *Lechriorchis validus*, Nicoll (1911); but in all these cases the external pore is small and situated at the posterior end of the body.

To what extent the specialization of this parasite may have been brought about by the fact of its inhabiting a host so specialized in structure and mode of life as *Protopterus* is a question of great interest, but one to which it is scarcely possible to attempt an answer. One is tempted to speculate on the possible function of the dorsal sac with its enormous aperture, and to question whether it is in any way an adaptation to the circumstances which arise owing to the æstivation of the host during the dry season—whether, for example, it is a reservoir for the excretory products during this period, or whether it may have an additional function, *e. g.*, in subserving respiration.

Quite apart from this question of function, the homologies of the various parts of the excretory system are by no means clear. It would be of great interest to decide whether the dorsal sac really represents the usual excretory vesicle of the digenetic Trematodes, or whether it is a new structure specially developed, possibly as an invagination of the external skin. The latter view has a serious drawback in the existence of a special lining epithelium in the sac, which differs totally in character from the outer covering of the body.

On the other hand, if the sac is homologous with the usual vesicle, the enormous size of its aperture and its dorsal position have to be accounted for, and there remain also as problems the terminal bladders of the two collecting vessels and the small diverticulum of the sac into which they apparently open. The histology of the walls of these various parts might be expected to throw some light on the question, and the evidence of my material, so far as it goes, seems to be that the thick epithelium of the sac is not continued into the diverticulum and the two "bladders," but that the latter have thin walls consisting of comparatively flattened cells, while the diverticulum has a considerably thinner epithelium than the large sac. Owing, however, to the imperfect preservation for histological details, it is impossible to lay much stress on such a point.

On the whole, I am inclined to the view that the sac and its diverticulum together probably represent the stem of the Y-shaped excretory vesicle of the Lepodermatidæ, the two terminal bladders of the collecting-tubes being the homologues of the divergent anterior branches. Upon this view, the dorsal sac is not a new invagination from the exterior, but a modification of the terminal portion of the vesicle. How it has been developed to this extraordinary extent, and what may be the advantage gained by having the aperture enlarged from a minute pore to a gaping opening nearly as wide as the whole animal, and, instead of being situated, as usual, at the posterior end of the body, moved forward to a position considerably anterior to this on the dorsal side, are at present unanswerable questions.

I am not aware of any case among Trematodes in which the excretory pore has a similar size and position. In certain forms (e. g., *Urogonimus*) in which the genital pore is situated at the hinder end of the body, the excretory pore is displaced somewhat to the dorsal side. But in other Digenea, I believe, where the excretory pore or pores are not terminal, they open on the ventral side. In all cases the pores are minute, and closed either by a special sphincter muscle or by the ordinary musculature of the body-wall (Braun, 1893, p. 641).

It is an interesting and somewhat remarkable fact that the members of the three genera (*Ochetosoma*, *Renifer*, and *Lechriorchis*) which have already been mentioned as, apparently, the nearest relatives of the present species are, with very few exceptions, parasitic in snakes. Odhner has pointed out (1911, p. 55) that these genera, together with *Pneumatophilus*, Odh., and *Leptophallus*, Lühe, form within the family

Leptodermatidæ a well-marked group of parasites inhabiting the mouth, lungs, œsophagus, and stomach of snakes. It would seem that most of them have a preference for situations more or less accessible to the outer air. It is not a little striking, therefore, though probably a pure coincidence, that an allied form is now found inhabiting a fish which is specially adapted for breathing air. In this case, however, the parasite lives in the intestine, and I have no information to show that it could obtain access to the air. The relationship, moreover, if any, between the Dipnoi and the Reptilia is of the remotest character, and the presence of related parasites in both groups probably has no special significance.

The following is a provisional diagnosis of the new genus:—

HETERORCHIS, gen. nov.

Lepodermatidæ; with body flattened anteriorly, but much swollen posteriorly, covered at the anterior end and on the sides to near the posterior end with small scales. Œsophagus very short; intestinal cæca extending nearly to the posterior end of the body. A very large excretory sac is present on the dorsal side, with a very wide aperture situated dorsally at some distance from the posterior end. Two main excretory vessels present. Genital aperture situated midway between the oral and ventral suckers, almost at the extreme left side of the body. Cirrus-sac long and curved, containing a large vesicula seminalis (divided into a non-muscular proximal portion and a muscular distal portion), a small bulbous pars prostatica, numerous large prostatic cells, and a long eversible cirrus. Testes elongate, with entire margins; unequal in size, the right testis being considerably longer and situated farther back than the left. Ovary lobate, on the right side, behind the ventral sucker. A receptaculum seminis present, behind the ovary. Yolk-glands occupying about the middle third of the body, arranged in irregular masses along the sides. Uterus forming a double sinuous loop at the posterior end of the body, and having a very wide, sinuous ascending limb. Vagina running nearly parallel to the cirrus-sac, long and provided with strong circular muscles. Eggs 0·04 mm. in length.

Type, *H. crumenifer*, sp. n.—with the characters of the genus.

Hab. Intestine of *Protopterus æthiopicus*: Lake Victoria, Uganda.

Syntypes in the British Museum (Natural History).

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XIV.—*Descriptions and Records of Bees.*—LXIX.

By T. D. A. COCKERELL, University of Colorado.

Parasphecodes cervicalis, sp. n.

♀.—Length 10–11 mm.

Black, robust; closely allied to *P. dissimulator*, Ckll., differing thus:—Face narrower, eyes more converging below; flagellum only very faintly reddish at end; stigma dark rufo-fuscous; nervures more slender, fuscous; wings variable in tint, but not so red; dark hair on outer side of hind tibiæ dark sooty; brush at apex of hind basitarsus not brilliantly coloured; tubercle on second ventral segment hairy, but without a well-defined tuft. It is easily known from *P. noachinus*, Ckll., by the much more densely punctured mesothorax and the more finely and closely punctured first abdominal segment.

Hab. Eaglehawk Neck, Tasmania, Feb. 12–Mar. 3, 1913 (*R. E. Turner*). British Museum.

At Mt. Wellington, Tasmania, Jan. 15–Feb. 6, 1913, Mr. Turner took specimens of *P. plorator*, Ckll.

Parasphecodes latissimus, sp. n.

♀.—Length about or almost 10 mm., abdomen 3·25 mm. broad.

Head (including antennæ), thorax, and legs black; abdomen very broad, dark chestnut-red, first segment black except broad hind margin; second and third segments each with dark spots at extreme sides, that on third much larger than that on second; hair of pleura and sides of metathorax rather abundant, dull white, that of front, vertex, mesothorax, and scutellum thin, dark fuscous, of postscutellum ferruginous; head broad; mandibles dark red at extreme tip; clypeus shining, sparsely punctured; front dull, mesothorax moderately shining, with very small punctures, well separated in central region, longitudinal groove distinct; scutellum sculptured like mesothorax, but punctures a little smaller; area of metathorax with close wrinkled rugæ, not confined to the basal half; posterior truncation sharply defined, the upper lateral corners prominent; tegulæ piceous with a large rufous spot. Wings strongly dusky, stigma and nervures dark rufo-fuscous, outer r. n. and t.-c. thin, but dark and distinct; first r. n. meeting second t.-c.; second s.m. broad. Hair of legs largely pale, but black on outer side of middle and hind tibiæ, shining creamy-white on inner side of hind tibiæ, orange on inner side of tarsi; hind spur simple. Abdomen with excessively fine punctures on first two segments; no hair-bands or patches, hair at apex dark fuscous.

Hab. Bridport, Tasmania, 26–30 Oct., 1913 (*Littler, 2557*).

Closely allied to *P. recessus*, Ckll., but rather larger, with dark fuscous hair on mesothorax, strongly dusky wings, punctures of mesothorax ordinary, tegulæ not black, hair on outer side of middle tibiæ black.

Halictus cyclognathus, Cockerell, var. *a.*

♂.—Middle and hind tarsi dark, the basitarsi black.

Three from Eaglehawk Neck, Tasmania, Feb. 12–Mar. 3, 1913 (*R. E. Turner*). British Museum.

At the same locality and time Mr. Turner took a male of *H. niveifrons*, Ckll.

Halictus isthmalis, Cockerell.

♀.—Length about or a little over 6 mm.

Black, including legs, antennæ, and mandibles; head broad, clypeus shining, black, with strong scattered punctures; front dull, somewhat glistening at sides; mesothorax shining, with strong punctures, well separated on disc;

scutellum with minute punctures; area of metathorax finely, regularly plicatulate, the plicæ more or less joined by little transverse ridges; tegulæ black. Wings strongly greyish; hair on inner side of tarsi light fulvous. Abdomen very broad, shining, finely but not closely punctured; lateral bases of second and third segments with small triangular patches of white tomentum; caudal rima pale brownish; hind margins of segments wholly dark; venter with white hair.

Hab. Eaglehawk Neck, Tasmania, Feb. 12–March 3, 1913 (*Turner*). British Museum.

This was taken at the same time and place as numerous male *H. isthmalis*, and, in spite of the dusky wings, I feel assured that it is the female of that species. The general characters, sculpture, &c., are quite the same.

Halictus pulvitectus, sp. n.

♀.—Length 6·5–7 mm.

Black, robust, hind margins of abdominal segments testaceous, the first very narrowly, the others successively more broadly, the fourth having a broad whitish margin; pubescence rather dull white above and below, giving the insect a dusty appearance, especially on the fourth abdominal segment, which is conspicuously though thinly hairy; head broad; mandibles black, at most slightly marked with dark red; clypeus shining, very sparsely punctured; front dull in middle, shining at sides; flagellum short, with only a slight reddish tinge; mesothorax and scutellum shining, closely and finely punctured; area of metathorax glistening, very delicately plicatulate, but irregularly, the effect being that of an indistinct network rather than well-defined striæ; tegulæ rufo-piceous. Wings brownish, stigma and nervures rather dilute reddish brown; second s.m. broad, but third much broader; outer r. n. and t.-c. much weakened; first r. n. meeting second t.-c. Legs black, with white hair; brush at end of hind basitarsus bright red. Abdomen broad, shining, with extremely fine punctures. Microscopical characters: front densely and minutely punctured; mesothorax not sculptured between the punctures; hind spur with numerous very small stout teeth.

♂.—Length about 6 mm.

Similar in general characters, including a swelling on each side of first and second abdominal segments; head broad; labrum and mandibles (except base) ferruginous; clypeus with an apical cream-coloured band; flagellum long, moniliis microscopically tessellate, and the plicæ on basal half are irregular, many of them imperfect.

Hab. Tambourine Mountain, Queensland, Oct. 27, 1912 (*H. Hacker*). Queensland Museum, 95.

Allied to *H. hedleyi*, Ckll., of which only the male is known; the venation differs conspicuously from that of *hedleyi*, and I do not believe *H. cyclurus* can be its female.

The following five species of black *Halictus* from Tasmania constitute a puzzling series, shown by their microscopical characters to be distinct from one another and from previously described forms. I have named them in memory of men connected with the history of Tasmania. The following key separates them on the microscopical characters:—

Front finely striate. (Scape minutely punctured; mesothorax tessellate, with fine, rather close punctures; area of metathorax with minute wavy plicæ, from which arise many short projections; abdomen distinctly punctured.) . . . . *H. baudini*, Ckll.

Front with irregular minute labryinthiform wrinkles. (Mesothorax tessellate, with very minute sparse punctures; area of metathorax very finely plicatulate, the ridges partly anastomosing, reaching fully three-quarters distance to margin, the surface between the plicæ minutely tessellate; abdomen finely lineolate, with only very minute piliferous punctures; hind spur of ♀ with a few stout, not very long teeth.) . . . . *H. furneauxi*, Ckll.

Front densely punctate, so densely as to appear minutely cancellate . . . . 1.

1. Area of metathorax with strong irregular plicæ, confined to basal half, but the surface minutely lineolate-reticulate, the more directly continuous lines running transversely. (Mesothorax rough with a minute tessellation, and finely but rather closely punctured.) . *H. boweni*, Ckll.

Area of metathorax plicate or reticulate over most of the surface . . . . 2.

2. Mesothorax dull, the disc minutely regularly tessellate, with widely separated minute punctures; at sides the punctures are relatively large and dense, with the intervals finely striate-wavy. (Area of metathorax with coarse, irregular, labyrinthiform wrinkles, more transverse than longitudinal; abdomen distinctly punctured.) . . . . *H. blighi*, Ckll.

Mesothorax shining, the disc with the surface-markings irregular and the punctures, especially posteriorly, rather large and tending to be bordered by plicæ, or the punctures may be more or less confluent. (Area of metathorax coarsely irregularly reticulate; abdomen well punctured.) . . . . *H. bassi*, Ckll.

The following table will further facilitate identification:—

	Females	1.
	Males	4.
1.	Hind margins of abdominal segments pallid or testaceous	*H. pulvitectus*, Ckll.
	Hind margins of abdominal segments dark	2.
2.	Mesothorax (seen under a lens) distinctly punctured	3.
	Mesothorax feebly or very minutely punctured	*H. furneauxi*, Ckll.
3.	Small, wings greyish	*H. isthmalis*, Ckll.
	Larger, wings brownish	*H. littleri*, Ckll.
4.	Clypeus all dark	5.
	Clypeus with a light marginal band	6.
5.	Antennæ rather short, face very hairy	*H. niveifrons*, Ckll.
	Antennæ very long	*H. blighi*, Ckll., and [*H. bassi*, Ckll.
6.	Very minute, mesothorax very shiny	*H. cyclognathus*, Ckll.
	Medium size	7.
7.	Tegulæ amber, tibiæ red	*H. hæmatopus*, Ckll.
	Not thus brightly coloured on tegulæ and legs	8.
8.	Smaller, tarsi red or reddish	*H. isthmalis*, Ckll.
	Larger, tarsi dark	*H. baudini*, Ckll., and [*H. boweni*, Ckll.

Halictus furneauxi, sp. n.

♀.—Length about 7 mm., anterior wing 5 mm.

Black, robust, with thin dull white hair, very pale yellowish on inner side of tarsi; head broad; mandibles strongly bidentate, deep chestnut-red apically; clypeus shining, with large irregular punctures, more or less in longitudinal rows; supraclypeal area dullish, with very minute punctures; antennæ black; mesothorax dullish, with extremely minute punctures; area of metathorax weakly and finely plicatulate; tegulæ rufo-piceous. Wings grey; stigma large, dilute reddish brown; outer r. n. and t.-c. extremely weak; second s.m. very broad, but third broader; first r. n. meeting second t.-c. Legs black, hind legs obscurely brownish. Abdomen shining, without evident punctures; basal corners of third and fourth segments with white hair, the fourth with quite dense patches; venter with straight (not curled) white hair.

Hab. Eaglehawk Neck, Tasmania, Feb. 12–March 3, 1913 (*Turner*). British Museum.

Superficially like *H. sturti*, Ckll., but easily separated by the less shining mesothorax and more delicately sculptured area of metathorax.

Halictus blighi, sp. n.

♂.—Length about 6 mm.

Slender, black, with thin but rather long white hair; head very broad, eyes strongly converging below; clypeus shining, wholly black; antennæ extremely long (reaching metathorax), black, flagellar joints moniliform; mesothorax dull, finely punctured; area of metathorax large, well defined, appearing under a lens finely irregularly cancellate; tegulæ rufo-piceous. Wings greyish hyaline, stigma and nervures piceous; first r. n. joining the rather narrow second s.m. before end; third s.m. very broad; outer r. n. and t.-c. thin, but distinct. Legs black, with pale hair; anterior tibiæ partly dark reddish. Abdomen shining, with thin white hair at sides and apex; apical plate broadly rounded.

Hab. Mt. Wellington, Tasmania, Jan. 15–Feb. 6, 1913 (*Turner*). British Museum.

Looks like *H. plebeius*, Ckll., but separated by the quite different antennæ, dark clypeus, dullish and sculptured scutellum, &c.

Halictus bassi, sp. n.

♂.—Length about 5·5 mm.

Much like *H. blighi*, but with the following special characters:—Mandibles broadly red apically; disc of mesothorax shining between the punctures.

Variety *a*.—Only two submarginal cells, the first t.-c. absent.

Hab. Mt. Wellington, Tasmania, Jan. 15–Feb. 6, 1913 (*Turner*). British Museum.

Possibly a variety of *H. blighi*, which it resembles in everything of importance except the sculpture of the mesothorax, which is quite distinctive.

Halictus baudini, sp. n.

♂.—Length about 7 mm.

Black, rather robust, with long thin white hair, that on front of head and head and thorax above tinged with reddish brown; head very broad; mandibles black or reddish apically; clypeus shining, sparsely punctured, with a broad cream-coloured band; supraclypeal area dull, abruptly contrasting with clypeus; antennæ extremely long, flagellum moniliform, faintly brownish beneath; mesothorax moderately shining in middle, otherwise quite dull; scutellum shining; area of metathorax appearing coarsely granular under a lens; tegulæ piceous, with a brown spot. Wings greyish, stigma and nervures dilute red-brown; second s.m. very broad; first r. n. meeting second t.-c.; outer r. n. and t.-c. distinct. Legs black. Abdomen broad, shining black, without hair-bands or patches; a broad dark red apical plate.

Hab. Mt. Wellington, Tasmania, Jan.–March, 1913, 3 ♂ (*Turner*). British Museum.

Larger than *H. repertus*, Ckll., with quite different area of metathorax, &c.

Halictus boweni, sp. n.

♂.—Length a little over 6 mm.

Superficially like *H. baudini*, but differing thus:—A little smaller; head smaller, eyes more converging below; anterior and middle tibiæ light red in front; area of metathorax concave, with plicæ not covering surface; scutellum finely punctured all over, without any median depression; abdomen much narrower; stigma darker; second s.m. much narrowed above.

Hab. Eaglehawk Neck, Tasmania, Feb. 12–March 3, 1913 (*Turner*). British Museum.

Paracolletes subviridis, sp. n.

♀.—Length 9·5 mm.

Rather slender, apparently black, but on close inspection it is seen that the front, mesothorax (except a large central area), and abdomen are faintly greenish, the colour extremely obscure; hair of head and thorax dull white, partly black on clypeus and extreme sides of face, black on vertex (but white on occiput), largely black or fuscous on mesothorax, scutellum, and postscutellum; head very broad; mandibles entirely black; clypeus shining, with strong, not very dense punctures; supraclypeal area polished, punctured at sides; front dull, moderately shining at sides; antennæ black; mesothorax dull, moderately shining on disc, with only minute piliferous punctures; scutellum shining anteriorly; postscutellum dull, a little produced and tufted in middle; area of metathorax shining, without evident sculpture; tegulæ dark reddish. Wings hyaline, not at all reddish, nervures and stigma dark rufo-fuscous; b. n. meeting t.-m.; first r. n. reaching second s.m. at middle; second r. n. joining third s.m. a moderate distance from end. Legs black, with dull whitish hair, fulvous on inner side of basitarsi, black or dark sooty on outer side of middle and hind tibiæ ; hind spur with long slender spines. Abdomen dullish, with very little hair, but third and fourth segments with thin white hair-bands, that on third interrupted in middle ; hair at apex of abdomen black ; hair of venter white.

Hab. Bridport, Tasmania, Oct. 26–30, 1913 (*Littler*, 2565).

Differs from *P. obscurus* (Sm.) by the black mandibles, tibial scopa beneath white (not yellow), dull thorax, &c. There is a curious superficial resemblance to *P. advena* (Sm.), but *subviridis* is a much narrower insect.

Other bees recently taken by Mr. Littler in Tasmania are :—

Paracolletes melbournensis, Ckll. Georgetown, 16 and 23 Nov., 1914.

Paracolletes leai, Ckll. Georgetown, 17 and 29 Nov., 1914.

Binghamiella antipodes (Sm.), ♀. Georgetown, 15 Nov., 1914.

Exoneura hamulata, Ckll., var., ♂. Bridport, 26–30 Oct., 1913.

Euryglossa fasciatella, Ckll., ♂. Swan Point, R. Tamar, 14 Oct., 1914.

Going over my material of *Paracolletes melbournensis*, I observe that certain specimens from Victoria (*French*) and Sydney (*Froggatt*) are between *mimulus* and *melbournensis*, being smaller, with the hair of mesothorax very red, without conspicuous dark hair. They possibly represent a variety of *P. mimulus* rather than of *melbournensis*, or a third species, very close to the others, may be indicated. Australian students will be able to settle the matter by field-studies.

Paracolletes providus (Smith).

I refer here a male from Eaglehawk Neck, Tasmania, Feb. 12–March 3, 1913 (*R. E. Turner*). It is about 7 mm. long, with shining dark purple abdomen. Is this, perhaps, the true *P. chalybæus* (Erichs.)? It is not *chalybæus* as understood by F. Smith.

XV.—*A new Agrionine Dragonfly from Northern Australia.*

By HERBERT CAMPION (Imperial Bureau of Entomology, London).

A FEW dragonflies have been included from time to time in the collections of insects sent to the Imperial Bureau of Entomology, for identification, by Mr. Gerald F. Hill, the Government Entomologist of the Northern Territory, Australia. Among these I find a small male and female evidently belonging to an undescribed species of *Austroagrion*, Tillyard, an Australian genus containing, so far, two species only. The main definition of *Austroagrion*, with which the present species agrees, will be found in Proc. Linn. Soc. N. S. Wales, xxxvii. 1912, p. 466 (1913). On p. 449 of the same publication, however, an additional character is given, namely, "Superior appendages of male longer than inferior," but in our male the two pairs of appendages are about equal in length.

The new species may be immediately distinguished from *Austroagrion cyane*, Selys, to which it appears to come nearest, as well as from *A. cæruleum*, Tillyard, by the form of the anal appendages in the male. For the two older species these appendages have been figured both by Dr. F. Ris ('Fauna Südwest-Australiens,' ii. 24, figs. 10 & 11, 1910) and by Mr. R. J. Tillyard (*l. c.* pl. xlviii. figs. 27–30, 1913), and Dr. Ris's figures are accompanied by a parallel statement of other differences between the insects compared.

The following key will separate the males of the three species, but I have made no attempt to tabulate the respective females:—

Lower anal appendages, in profile view, conspicuously shorter than the upper appendages, and without any central posterior process.
  Segments 8 and 9 entirely blue .... *cæruleum*, Tillyard.
  Segments 8 and 9 blue and bronze-black ...... *cyane*, Selys.
Lower anal appendages, in profile view, nearly as long as the upper appendages, and with a long central posterior process; segments 8 and 9 blue and bronze-black .... *exclamationis*, sp. n.

For the loan of material of *A. cyane* I am indebted to the kindness of my friends Dr. F. F. Laidlaw (1 ♂, Illawarra, N.S.W.) and Mr. K. J. Morton (1 ♂, 1 ♀, Gisborne, Victoria).

Austroagrion exclamationis, sp. n.

♂ (holotype). Koolpinyah, Northern Territory, 6. iii. 1913, *G. F. Hill*, numbered by the collector 421.

Length of abdomen 19·5 mm.; length of hind wing 12 mm.

Labium yellowish white. Labrum, anteclypeus, and genæ light green. Postclypeus shining greenish black. Frons light green, with a large lunulate black spot lying a little in advance of the anterior ocellus. A rectangular spot of greenish yellow connects each posterior ocellus with the anterior ocellus. Head behind the antennæ black, with greenish reflections. Postocular band narrow and obscure. Basal joint of antenna light green; second joint blackish; remainder missing.

Pronotum black, with greenish reflections; anterior margin broadly light green; a broad linear spot of light green near each external border; hind margin narrowly lined with light green, except where a conspicuous median triangular lobe projects backwards. Sides of prothorax light green.

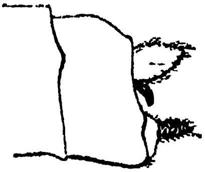
Thorax proper greenish gold above, with a broad median band of bronze-green, and a narrower juxtahumeral band of the same colour on each side; sides of thorax pale green, with a short black line near the base of the first lateral suture, and a still shorter black line, or rather spot, at the base of the second lateral suture.

Legs whitish, with some brownish black on the femora externally; spines of femur and tibia and tips of claws black.

Pterostigma pale greenish yellow. Eight postnodals in the fore wings, and six or seven in the hind wings. M_2 originating a little proximal to the fourth postnodal in the fore wings and at or a little before the third postnodal in the hind wings. M_{1a} arises a little distal to the sixth or seventh postnodal in the fore wings and at the sixth postnodal in the hind wings. Venation otherwise similar to that of *A. cyane*.

Abdomen blue, with bronze-black markings. Segment 1 with the dorsum almost entirely bronze-black; 2 with a spot extending from base to apex, slightly constricted a little beyond the middle; 3 occupied for its entire length, except quite near the base, by a spot somewhat resembling the note of exclamation (!) in form, the greatest constriction occurring at about three-quarters the length of the segment; 4 and 5 marked much like 3, but with a little more of the blue ground-colour exposed basally; 6 and 7 entirely bronze-black, except just near the base; 8 and 9 mostly blue, with a large, apical, triangular spot directed towards the base of the segment; 10 wholly bronze-black; sides of abdomen blue; abdomen beneath very pale, slightly bluish.

Anal appendages, viewed in profile, well separated, nearly equal in length, and not quite as long as segment 10; the upper appendage subovate, pale, giving rise to a strong black basal spur below, directed slightly backwards and towards the lower appendage; the lower appendage black, simple, almost straight, subcylindical, and resting upon a pale bulbous base. In dorsal view the suporior appendages are subconical and slightly divergent; the inferior appendages are curved inwards, and a conspicuous pale tooth projects inwards and backwards from the base of each.



Austroagrion exclamationis, sp. n., type ♂. Left profile-view of anal appendages.—H. Knight del.

♀ (allotype). 30 miles E. of Darwin, Northern Territory, 10. xii. 1914, *G. F. Hill.*

Length of abdomen 17·5 mm.; length of hind wing 12 mm.

Labium yellowish white. Labium and genæ yellowish. Anteclypeus pale green. Postclypeus dark green. Frons yellowish, marked with a lunulate black spot, as in male. Head behind the antennæ dull black, with a pair of rectangular yellow spots connecting the ocelli, as in male. Postocular band narrow, greenish yellow. Basal joint of antenna yellowish; second joint blackish; remainder missing.

Pronotum glossy black, bordered as in male, excepting that the hind margin appears to be lined with light green uninterruptedly; the hind margin more distinctly trilobed than in male. Sides of prothorax pale green.

Thorax proper as in male.

Legs as in male, but with the dark markings on femora externally reduced and less intense.

Pterostigma pale greenish yellow. Eight postnodals in the fore wings and six or seven in the hind wings. M_2 separating at the fourth postnodal in the fore wings, and between the third and fourth postnodals in the hind wings.

M_{1a} at the level of the seventh postnodal in the fore wings, and the last postnodal in the hind wings. Venation otherwise like that of *A. cyane*.

Abdomen: ground-colour of proximal half greenish blue, of distal half greenish brown; bronze-black markings on dorsum; segments 1 to 4 marked as in male; markings on 5 to 7 also as in male, but somewhat larger, and exposing less of the ground-colour; 8, 9, and 10 mostly, but not entirely, covered with bronze-black; 10 with the hind margin conspicuously notched in the mid-dorsal line. Anal appendages short, subconical, blackish. Ovipositor greenish brown, reaching to end of abdomen; palps projecting beyond end of abdomen, blackish, slightly recurved.

The types have been deposited in the British Museum (Natural History).

XVI.—*On a new Flat-fish of the Genus* Arnoglossus *from the Black Sea*. By PETER SCHMIDT, Curator of the Ichthyological Department of the Zoological Museum of the Imperial Academy of Sciences in Petrograd.

IF we omit doubtful species, there are only three flat-fishes (Heterosomata) known from the Black Sea:—

(1) *Rhombus mæoticus*, Pall.
(2) *Pleuronectes flesus*, L.
(3) *Solea nasuta*, Pall.

It is therefore, perhaps, of some general interest that in the collections of the Zoological Museum of the Imperial Academy of Sciences in Petrograd I found a fourth and very interesting new species belonging to the genus *Arnoglossus*. In memory of the late eminent Russian ichthyologist Prof. K. F. Kessler, I have named this species *Arnoglossus kessleri*.

Arnoglossus kessleri, sp. n.

D. 74–76. A. 53–57. P. 9–11. V. 6. C. 17.
L. l. 38. Vert. 33.

Eyes on the left side. Body oval, with very short caudal peduncle. The height of the body is 38 % of the total length, the length of the head 21 %. The length of the caudal peduncle (without the part of the caudal fin covered with scales) is ½ of its least height. The mouth is very small and obliquely directed upwards. The posterior end of the maxilla is on a line through the anterior edges of the eyes. The body is covered with very large, ctenoid, deciduous scales. The lateral line has 38–40 scales with pores; above the lateral line are 8, below 10 rows of scales; the anterior part of the lateral line forms a distinct arch. The dorsal fin has 74–76 rays, and commences before the eye on the right (eyeless) side; the two first rays are not prolonged, but their ends are free. The greatest height of the dorsal fin is behind its middle and equal to 10 °/₀ of the total length of the body. The anal fin has 53–57 rays; its height is the same as that of the dorsal. The caudal fin has 17 rays, is rounded, and has the base covered with scales. The pectoral fins are not of the same size: the length of the left is 12 °/₀, the length of the right 7·6 °/₀ of the total length of the body. The ventrals also are different—the left is twice as long as the right. Between the ventral fins near the anus is a projecting spine, formed apparently by the postclavicle and directed backward (the same spine is present in *Arnoglossus grohmanni*, Bon., but it seems to have been undescribed). The colour of the upper side is brownish, covered with black spots and points; the eyeless side is yellowish. The small specimens of the south coasts of Crimea are very transparent, so that one can count the vertebræ (their number is 33), and one can see along the bases of the dorsal and anal fins two dark stripes extending from the body-cavity to the caudal peduncle. With the microscope one can detect that these stripes are ovaries with ripe eggs.

The length of the body is 46 to 66 mm., and specimens of 47 mm. are already full-grown and ripe.

This new species of the Black Sea is near to *Arnoglossus grohmanni*, Bon., of the Mediterranean, but differs in the smaller mouth, larger scales, fewer vertebræ (*A. grohmanni*, Bon., has 38 vertebræ), different number of rays in dorsal and anal fins, and absence of prolongations of the first two dorsal rays. The small size is very characteristic—it seems to me that this is the smallest flat-fish in the world.

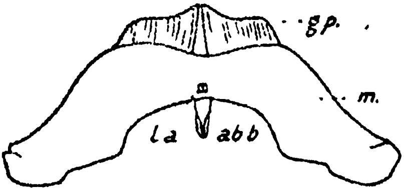
Arnoglossus kessleri was found at two localities in the Black Sea: one specimen by Mr. Jagodovsky near Sukhum (on the east coast of the Black Sea), at a depth of 3–4 metres, and six specimens by Mr. Sernoff near Sudak (on the south coast of the Crimean peninsula), at a depth of 3–7 fathoms. It appears, therefore, that it has a wide distribution in the Black Sea. Probably it can be found there everywhere near the coasts.

XVII.—*Note on an Interesting Abnormality in the Mandibular Arch of* Chimæra monstrosa, *L.* By WALTER E. COLLINGE, M.Sc., F.L.S., &c., Research Fellow of the University of St. Andrews, The Gatty Marine Laboratory, St. Andrews.

SOME little time ago, whilst examining the visceral arches in a specimen of *Chimæra monstrosa*, I met with an interesting abnormality in the form of a small bony substance situated immediately posterior to the mandibular symphysis. More recently, in examining further examples of this Chimæroid, I had the good fortune to meet with a further but somewhat similar abnormality. Having failed to find any mention of a like occurrence in any of the accounts of the cranial anatomy of this fish, a note upon the same may not be without interest.

In the first specimen the abnormality consists of the presence of a small plate-like bone, not unlike in general shape the urohyal of some Teleostei. It is situated immediately behind the lower posterior border of the mandibular symphysis, being attached to each ramus by a short strong ligament (fig. 2, *lig.*), which latter is inserted at the two points marked *l.a.* in fig. 1. The bone is about 5 mm. long, and readily stained with a special stain for osseous tissues. Looked at from the ventral side, it is seen to consist of an anterior triangular plate with a somewhat longer tail-like portion posteriorly (fig. 2), the whole being confluent with a dorsal expanded plate. In transverse section through the anterior portion (fig. 2 *a*) the bone has the shape of a collar-stud (fig. 3 *a*), whilst a section through the posterior part

Fig. 1.

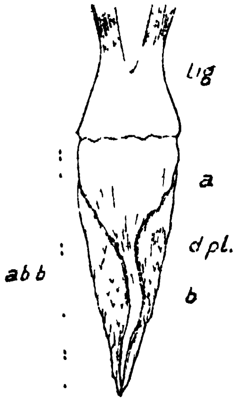


Outline figure of the mandible of *Chimæra monstrosa*, showing the position of the abnormal bone.

ab b, abnormal bone; *g.p.*, grinding-plate; *l.a.*, points of attachment of ligaments; *m*, mandible.

shows the body of the narrow tail-like portion and the termination of the dorsal plate (fig. 3 *b*).

Fig 2.



Abnormal bone, first case.

a, triangular anterior portion ; *b*, tail-like posterior portion ; *d pl.*, dorsal plate ; *lig*, ligament.

Fig. 3.

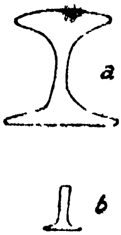


Fig. 4.

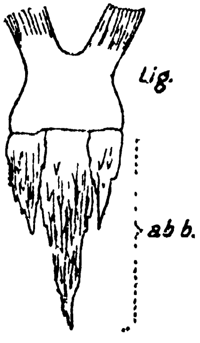


Fig. 3.—Sections, (*a*) through the triangular anterior portion, (*b*) through the tail-like posterior portion. Marked *a* and *b* respectively in fig. 2.

Fig. 4.—Abnormal bone, second case. *ab.b*, abnormal bone; *lig*, ligament.

In the second specimen the bone consists of a thin plate-like structure, having the appearance, when looked at from the ventral side, of a median, flat, wedge-shaped body, with a similar but smaller body on each side and ventral to the median one, although the whole of the plate is one (fig. 4). The ligament is rather shorter than in the previous case. The structure of the bone agrees with the dorsal plate of that shown in fig. 2, and I am inclined to regard it as representing that portion only, the ventral portion being absent.

So far as I am aware, there is no corresponding median bone in this region in any recent fish, the nearest, perhaps, being the jugular plate of *Amia*, which these certainly do not represent. As remarked, the bone, in the first case, is strikingly like the urohyal of some Teleostei, but, apart from other considerations, its situation in close proximity to the mandibular symphysis at once shows that this is nothing more than an external likeness.

Jaekel * and Bashford Dean † have both shown that the structure of the jaws in the Holocephali have undergone considerable modification in connection with the development of the paired grinding-plates. On the lower jaw, which consists of two rami fused in front, there are present in *Chimæra* only two of these plates, but in the Jurassic Chimæroid, *Myriacanthus*, in the region of the mandibular symphysis there "occurs an azygous chisel-shaped tooth which is known only in this genus and in the kindred *Chimæropsis*"; in both of these instances the tooth is presymphysial. According to Schauinsland ‡ there is no trace of this median unpaired mandibular tooth in the earlier stages of recent Chimæroids.

The question naturally arises, Can these abnormalities in any way be regarded as reversions? The difficulty in doing so is undoubtedly, on first consideration, their postsymphysial position; but if we bear in mind that of the recent forms of Holocephali in *Chimæra* there has undoubtedly been a shortening of the snout and a more postero-ventral curve of the lower jaw, it is not difficult to imagine a form in which the presymphysial mandibular tooth took up a position similar to that of the abnormality here described. If, however, it does not represent this mandibular tooth, I am unable to offer any suggestion as to its probable homology.

There is, however, one further fact that lends weight to this probable homology, and that is the nature of the minute structure of these bones. The structure of the grinding-plates has been described by Schauinsland, who remarks:—"The first deposition of hard material begins at the outer surface of the papilla, and takes the form of a thin cap of dentine; soon, however, the tooth-substance appears below at the points where the plate is to come in contact with the cartilage of the head; and almost at the same time trabeculæ and lamellæ appear between (*i. e.*, in the substance of the plate), and produce a meshwork of spongy tooth-substance (pulp-dentine). The mode of origin of the plate resembles closely that of bone when derived from connective tissue (*e. g.*, in *Sphenodon*). The mesenchyme-cells in the papilla are collected together closely at certain points, and become transformed into odontoblasts, and from these, peripherally, the dentine takes its origin. Occasionally trabecules of the dental mass, especially in older individuals, show a somewhat lamellar structure, and those which are first differentiated—that is, those lying innermost—are distinguishable from the latter lamellæ by their capacity to become stained."

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* N Jahrb. f. Min. 1901, Beil. 14.

† "Chimæroid Fishes and their Development," Carnegie Inst., Washington, no. 32 (1906).

‡ "Beitrage z Entwick. und Anatomie der Wirbelthiere," Zoologica, 1903, vol. xvi. Heft 39, pp. 1 98, pls. xii. xxiv.

In *Chimæra* these two abnormal bones are, histologically, quite distinct from the ordinary osseous tissue of fishes. The nearest condition I have seen to what obtains here is in the development of certain bones in postlarval Pleuronectids *; and whilst I am not suggesting that these abnormal bones show the structure of the grinding-plates, as described by Schaunisland (*op. cit.*), they certainly present some features in common. The material at my disposal was not in a fit condition for any minute histological examination, but the series of closely massed strands, forming a meshwork of spongy material, strengthens the homology I have suggested.

I have pleasure in thanking Professor W. C. M'Intosh, F.R.S., for the wealth of material he has so generously placed at my disposal.

XVIII.—*On the Species of the Mascarene Viverrid* Galidictis, *with the Description of a new Genus and a Note on* "Galidia elegans." By R. I. Pocock, F.R.S., Superintendent of the Zoological Society's Gardens.

[Plate VII.]

Up to the present time only two species of this genus have been admitted, namely, the broad-banded form commonly cited as *Galidictis striata* and the narrow-banded form, *G. vittata*.

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* I have to thank Dr. H. M. Kyle for drawing my attention to this fact, after he had examined the first above-mentioned abnormality.

Fischer (Syn. Mamm. p. 171, 1829) long ago pointed out that the oldest name for the species described by Desmarest as *Viverra striata* is *fasciata*, assigned to it by Gmelin; and Schwarz (Ann. & Mag. Nat. Hist. (8) vii. p. 638, 1911) has recently given publicity to the same opinion, without citing Fischer, adding that the species described as *V. striata* by Desmarest is the *Galidictis striata* of later authors and of the present time, ignoring the circumstance that *Galidictis striata* is—generally, at all events—ascribed to Geoffroy St. Hilaire or Cuvier, and not to Desmarest. I have not troubled to trace the history of this animal through the voluminous bibliography of mammals, but the facts essential to my present purpose are as follows:—

Gmelin (Syst. Nat. i. p. 92, 1788) gave the name *Viverra fasciata* to the animal described and figured by Sonnerat as "Le chat sauvage à bandes noires des Indes" ('Voyage aux Indes,' etc., ii. p. 163, pl. xc., 1782). This figure, or the animal represented by it, if extant, is therefore the type.

Since Sonnerat described the colour of the iris and the shape of the pupil of the eye, it is clear that his description was taken from a living specimen in his possession at the time. Reliance therefore must be placed upon the characters he assigned to it. He described the colour as grey, washed with red ("lavé de roux") on the lower side of the head and neck, upon the thighs and feet, the belly being white. There are six black bands upon the body, beginning behind the head and ending towards the tail, which is covered with a mixture of black and reddish hairs ("garnie de poils noirs et de poils roussâtres"). The tail also was described as slender ("grêle"), which in this connection meant short-haired.

The colour of the tail and of the throat and limbs, as well as the slenderness of the tail, are to be particularly noted.

Buffon (Hist. Nat., Suppl. vii. p. 231, 1789) described the same species, with a new figure, as "Le putois rayé de l'Inde"; and Desmarest ('Mammalogie,' p. 210, 1820) gave it the technical name *Viverra striata*, referring to Gmelin's, Sonnerat's, and Buffon's descriptions, but ignoring Gmelin's specific name and adopting Buffon's illustration.

Now, it may be noted that Buffon's figure and description, although agreeing in the main with Sonnerat's, differ in some significant particulars, especially as regards the colour of the tail. Of the tail he says, "la queue . . . est couverte de poils bruns mêlés de fauve comme le dessus de l'occiput."

These discrepancies, coupled with Buffon's statement that the animal came from the Coromandel coast, no precise locality having been cited by Sonnerat, suggest the possibility of Buffon having procured a second specimen. If not, Sonnerat must have told him that he picked up the specimen on that coast of India. But even if two specimens were concerned, it seems obvious that they belonged to the same species, though possibly subspecifically distinct. However that may be, since Gmelin described Sonnerat's "Chat sauvage de l'Inde" as *Viverra fasciata*, and Desmarest gave the name *striata* to the same animal, Fischer had no choice but to drop *striata* as a synonym of *fasciata*.

Subsequently the species was described by F. Cuvier as "La Genette rayé de l'Indie," *Viverra fasciata*, Gmel. (Dict. Sci. Nat. xviii. p. 322, 1820). He quoted at length the description given by Buffon in the Supplement, stating that he had not himself seen the animal, which was no longer in existence—or, at all events, not available for examination.

So far all seems clear. But in 1826 E. Geoffroy St. Hilaire (Dict. Class. Nat. Hist. x. p. 214, and Cat. des Mamm. p. 98*) gave the name *Mustela striata* to a specimen presented to the Paris Museum by Sonnerat and stated, no doubt rightly and on Sonnerat's authority, to have come from Madagascar.

The discrepancies in the information as to the locality given by Sonnerat presumably to Buffon, and almost certainly to Geoffroy St. Hilaire, coupled with F. Cuvier's declaration as to the disappearance of the example described by Buffon, have an important bearing on the conclusion, supported by other facts, that the types of *V. fasciata*, Gmel. (=*striata*, Desm.), and of *Mustela striata*, Geoffr., were different individuals. Geoffroy St. Hilaire described the colour of *M. striata* as dark brown with five white longitudinal lines above, the tail white, and the underside of the body greyish white. It is significant that he made no mention whatever of Desmarest's *Viverra striata*, or of Buffon's and Sonnerat's figures and descriptions, although he must have been well acquainted with the works of these three compatriot naturalists. Nor did I. Geoffroy St. Hilaire, when discussing his father's species, suggest identity between the animals in question (Mag. de Zool. 2nd ser. i. 1839, pp. 32–33, pl. xviii.). The same applies to Cuvier, who redescribed Geoffroy's type of *Mustela striata* as *Putorius striatus* ('Règne Animal,' nouv. ed. i. p. 144, 1829).

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* The latter work I have not seen.

As a matter of fact, the two forms clearly differ in the colour of the tail, which is covered with black and red or brown and yellowish hairs in *Viverra fasciata*, Gmelin (=*striata*, Desm.), and with white hairs in *Mustela striata*, E. Geoffr. St. Hilaire. Nor do the descriptions of the latter published by Geoffroy and Cuvier justify the belief that the throat, thighs, and feet were washed with red *.

Since the two forms above discussed appear to belong to the genus *Galidictis*, it is clear that *striata* cannot stand for a white-tailed form, if the whiteness of that organ be regarded as of systematic importance. I am not aware that there is any evidence or any reason to think that either of the two forms described below as *Galidictis eximius* and *ornatus*, which have apparently been cited on many occasions as *G. striata*, are dimorphic in the colour of the tail † or that the legs and throat can ever be described as washed with red.

I propose, therefore, to give new names to two white-tailed forms of *Galidictis*, selecting as types examples from known localities in Madagascar, and leaving open the question as to their probable specific identity respectively with two examples described, one by E. Geoffroy St. Hilaire in 1826, the other by his son in 1839, to both of which the inadmissible name *striata* was attached.

Galidictis eximius, sp. n. (Pl. VII. fig. 1.)

Head greyish or yellowish brown, speckled black and tawny, the black speckling disappearing on the muzzle, cheeks, and round the eyes, but some longer speckled hairs lie backwards over the base of the ears and spread on to the antero-superior base of the pinna. For the rest the ears are covered with short white hairs in front and with yellow-brown and black hairs behind.

From the occipital region between the ears there extend backwards four black sinuous stripes, which are comparatively narrow and closely approximated over the nape and between the shoulders, although the external of the two on each side expands on the sides of the neck; but behind the shoulders they gradually broaden, then become narrow again towards the root of the tail. Between the two internal (admedian) of these stripes on the nape there are traces of a median stripe. A third broad stripe on each side runs along the lower area of the flank from the thigh to the shoulder, where it is interrupted for a short space, and then continued forwards across the shoulder on to the sides of the neck up to the infero-posterior base of the ear. The hairs of these black stripes are sooty-brown at the base and shining black distally.

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* In 1829 Buffon ('Œuvres Complètes,' viii. p. 43, pl. ccxxxvii. fig. 2), ignoring these differences, redescribed *Viverra striata*, giving references to Gmelin, Desmarest, and Geoffroy, without adopting the earlier name, *fasciata*, proposed by Gmelin. He reproduced in this work a coloured edition of the figure originally issued in his Supplement, and this figure clearly shows the tail and legs to be brown.

† The dichroism of the tail in the white-tailed mongoose (*Ichneumia albicauda*) is worth bearing in mind in this connection.

The stripes are separated throughout their extent by pale bands, dirty white, with very small dark tips on the body, but on the neck the dark tips are larger, so that the dark and light stripes are not so sharply differentiated. The underfur of these white stripes, as of the black ones, is olive-brown.

Thus the body is ornamented with six black stripes, separated by five pale stripes, and the pale stripes on the back are not darker than those traversing the sides.

The admedian black stripes pass on to the base of the tail, where they turn brown and coalesce to form large spots on the proximal four inches of the upper side of that organ, which for the rest of its length and along its whole underside is dirty white.

The outer side of the thighs is dusky blackish brown, and is marked above with a black stripe which extends to the stifle-joint (knee) beneath the posterior end of the infero-lateral body-stripe, from which it is separated by a whitish stripe continuous in front with the white of the belly. The hind feet are buffy white. The fore legs are the same tint approximately, but externally are clouded to a certain extent with dusky brown where the dark underfur shows between the longer hairs.

The whole of the underside from the chin to the anus and the insides of the limbs are dirty white, tinted with cream or buff upon the throat and the inside of the fore and hind limbs.

Measurements of dried stuffed skin.—Head and body 950 mm.; tail (without terminal tuft) 750; hind foot 230.

Loc. Ambinanindrano, E. Madagascar (*Archdeacon Kestell Cornish*).

Type, now in Brit. Mus., presented to Zoological Society 28. 5. 07, died 18. 9 07, described anatomically by Beddard (P. Z. S. 1907, p. 805) as *Galidictis striata*.

This new form certainly agrees with the specimen named *Mustela striata* by E. Geoffroy St. Hilaire in the whiteness of the tail and the presence of five white stripes extending down the back. It also agrees in the whiteness of the tail with the example which I. Geoffroy St. Hilaire identified as *striata* in 1839, stating that the type of his father's *striata* was a young individual of a species of which an adult had come into his hands from Madagascar, where it was procured by Goudot (Mag. de Zool. 2nd ser. 1839, pp. 32–33, pl. xviii.). The description he gives is unintelligible. He states that the body has five wide black bands and two others (smaller) on a greyish ground, making seven black stripes in all. But since the dark stripes in *Galidictis* are almost always symmetrically paired *, there cannot have been an odd number of them unless there was a median black stripe down the spine. This is not likely, but it is possible. Supposing, however, that it was so, his figure clearly shows that there must have been four black stripes, one of them short, on each side of the middle line, making a total of nine black stripes in all. There is clearly some mistake here.

From an examination of the plate accompanying Geoffroy's memoir it cannot be doubted, I think, that his animal had four black stripes (three long and one short) on each side of the body, making a total of eight, separated by seven pale interspaces.

To this pattern four specimens in the British Museum conform. Since two of these are young and two adult, it may be inferred that the difference in the number of stripes is not a question of age. Amongst the broad-striped, white-tailed forms of *Galidictis*, therefore, two styles of pattern are known, one with six black stripes and five pale interspaces exemplified by *G. eximius*, the other with eight black stripes and seven pale interspaces, exemplified by the species which I propose to name and describe as follows:—

Galidictis ornatus, sp. n. (Pl. VII. fig. 2.)

Resembling *G. eximius* in the whiteness of the greater part of the tail and other respects, but differing in the following particulars:—The head, the pale areas between the stripes, the legs, and ventral surface decidedly darker. The head is more heavily speckled with black, the dorsal interspaces distinctly speckled with black, the lateral interspaces washed with yellowish, the outside of the fore limbs and the thighs darker ashy grey, owing to the presence in the hairs of more black speckling, which is traceable down the hind leg almost to the toes; and there is more red in the hairs before the root of the tail and on the basal portion of that organ. The underside is washed with pale dirty yellow, which is everywhere darker than the throat of *G. eximius*, and nowhere presents the whitish-grey tint seen on the ventral surface of that animal.

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* The type of *G. vittata*, described below, has a faint short spinal stripe in the middle of the back, and a similar stripe is traceable on the fore part of the neck of *G. eximius*.

The black stripes have very much the same disposition and width as in *G. eximius*, but by reason of the darker tone of the interspaces are not so conspicuous. Moreover, the supero-lateral stripe, the uppermost of the series, is partially subdivided over the shoulders, and behind the shoulders is narrower than the homologous stripe in *G. eximius*, and intercalated between it and the broad lateral stripe there is a thinner shorter stripe which joins the supero-lateral stripe behind the shoulder, and thence passes backwards parallel to it to the root of the tail. In *G. eximius* this stripe is fused with, or not differentiated from, the supero-lateral stripe.

Loc. Andevoranto, E. coast of Madagascar, on the same latitude as Antananarivo (*R. Martin coll.*).

Type, B.M. reg. 76. 1. 31. 22.

In addition to the specimen above described (a male), there is in the British Museum a half-grown example resembling it ticketed "Madagascar (*Rev. C. W. Bewsher*)," and in the gallery are exhibited two stuffed specimens, also like it, except that the lateral interspaces are whiter, probably from exposure to light.

The splitting of *Galidictis fasciata* (*striata*) of authors into three forms necessitates pointing out that the type of the genus is the species represented by the specimen, procured by Goudot, which I. Geoffroy St. Hilaire named *Galidictis striata*, and not the species named *Mustela striata* by E. Geoffroy, nor the one named *Viverra striata* by Desmarest; and since that species is almost certainly identical with the one above described as *Galidictis ornatus*, it is highly probable that the type-species will take the latter name.

Now all the specimens of this species in the British Museum, as well as the single known example of *G. eximius*, resemble each other not only in the breadth of the stripes, but also in having the heel hairy and the rest of the hind foot naked as in *Cryptoprocta, Cynogale*, and all the typical genera of Paradoxurinæ, such as *Paradoxurus, Paguma*, and *Arctogalidia*, in which the hairiness of the heel is so constant a feature that generic importance is attached to it.

But in the two species next to be noticed, one of which was described long ago as *Galidictis vittata*, the heel is naked to the tip of the calcaneum. Those two also resemble one another in the narrowness of the stripes. This in itself could hardly be regarded as of generic value, but it appears to me that that value should be accorded to the nakedness of the heel.

MUNGOTICTIS, gen. nov.

Allied to *Galidictis*, but differing in having the heel naked and the longitudinal stripes narrow.

Type, *M. vittatus*, Gray.

On Sept. 16, 1886, the Zoological Society received as a present from Mr. B. Muller two so-called mongooses from Madagascar, which were identified as *Galidia elegans* *. Fortunately the skin of one of these, which survived its arrival only ten days, was preserved. A glance is sufficient to show that this specimen is not *Galidia elegans*, but is related to *M. vittatus*, Gray. Many years ago I put it aside as that species; but upon comparing it with Gray's type of *M. vittatus*, I find sufficient differences to warrant the conclusion that it represents a new form, which may be described as follows:—

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* This is the specimen referred to by Beddard in his paper upon *Galidictis striata* (=*eximia*) as a presumably correctly identified example of *Galidia elegans* (P. Z. S. 1907, p. 804). The point to which he drew attention was the presence in this supposed *Galidia* of $\underline{\text{pm } 1}$, a tooth which, according to Mivart, is absent in that genus, thus constituting one of the differences between *Galidia* and *Hemigalidia*—or *Salanoia*, as it should be called. This claim, however, was invalid at the time Mivart put it forward in 1882, because Geoffroy's figure of the skull of *Galidia elegans* published in 1830 shows this tooth in place. Thus *Galidia* and *Salanoia* may possess this tooth. *Galidictis*, on the other hand, is said to be without it—an inference based upon its absence in the skulls of examples identified as *G. striata* by Geoffroy and Mivart. But it was present, as Beddard stated, in the skull of *Mungotictis substriatus*. It seems, therefore, that the presence or absence of this tooth is not a generic feature in this group. Probably it has no systematic significance.

Mungotictis substriatus, sp. n. (Pl. VII. fig. 4.)

General colour of the back and sides dark olive-grey, due to the intimate speckling of the coat with black and buff-grey, the individual hairs being alternately annulated with those colours, the tip being black. Under reflected light the pale penultimate annuli of some of the hairs at least shine with a whiter lustre. On the back and sides there are ten indistinct, faint rusty brown, narrow longitudinal bands, all narrower than the interspaces. Of these, the first, the second, and the fourth, counting from the back downwards, are just traceable forward on to the shoulders, but not beyond. Posteriorly they fade away towards the root of the tail. The third stripe from the summit is much shorter. It extends only from about the middle of the body, where upon one side it joins the second stripe immediately above it, and vanishes behind on the rump. The fifth and lowest stripe is very faint and just traceable forwards on to the side of the shoulder. Underfur dusky brown.

The head is slightly darker than the body and more finely speckled. There is a conspicuous dirty white spot over the inner angle of each eye.

The fore legs externally from the elbow are yellowish buff, the black speckling of the hairs being hardly in evidence. The hind legs are much the same tint as the body as far down as the heels, the foot being mostly yellowish buff.

The tail is much the same tint as the body throughout, the hairs alternately banded broadly black and yellowish- or buff-grey. Chin, throat, chest, belly, and inside of limbs uniformly yellowish buff, paler on the chin and throat, richer posteriorly, especially on the anterior edge of the hind limbs. A conspicuous whorl of hairs near the middle of the throat and a pair of whorls on the fore part of the chest, the junction of the streams of hairs forming a transverse crest behind the interramal area, across the clavicular region, and down the fore part of the sternal region as in *Galidia elegans*.

Measurements of dried skin.—Head and body 850 mm.; tail 625; hind foot 150.

Loc. Madagascar.

Type (in Brit. Mus.), the specimen presented by Mr. B. Muller to the Zoological Society 16. ix. 86, which died 26. ix. 86.

Galidictis vittatus was described by J. E. Gray as follows:—" Grey, black and white grizzled ; back and sides eight nearly equal, parallel, narrow, black-brown streaks; chin and beneath pale brown; hind-feet and outer side of fore-legs brown . . ." (P. Z. S. 1848, p. 22).

The type, from Tulyah Bay, Madagascar, and in the British Museum, agrees tolerably closely with this description despite many years' exposure to light in the exhibition gallery. Probably, however, a certain amount of fading has taken place. The ground-colour of the back and sides is pale grey, approaching silvery grey, the head being darker; the legs, throat, and belly are yellowish buff, not brown as described. The back and sides are marked with eight dark rusty-brown stripes standing boldly out against the broader pale interspaces. Three of these on each side of the middle line pass forwards over the nape up to the occipital region, becoming gradually fainter in front of the shoulders, upon which they are strongly emphasized. The fourth from above on each side disappears in front of the base of the fore-leg, barely extending on to the side of the neck. Posteriorly towards the root of the tail and the back of the thighs these stripes fade away and become broken up into irregular spots. Beneath the fourth stripe from above on each side there is a faint fifth stripe which does not reach the elbow of the fore-leg; and in the middle of the back between the two uppermost of the paired stripes there is a faint spinal stripe stretching nearly from the withers to the croup. Thus there are eleven longitudinal dark stripes in all (Pl. VII. fig. 3).

So far as the stripes are concerned, the type of *M. vittatus* differs from that of *M. substriatus* in the following respects:—(1) The intensity of their colour; (2) the extension of three of them over the nape to the occiput; (3) the presence of a short faint spinal stripe; (4) the absence of the short stripe in the posterior half of the body below the second from the top; (5) the presence of the faint stripe below the fourth long stripe and just above the pale tint of the belly. For the rest, the ground-colour was apparently originally much paler, since Gray described the hairs as "black and *white* grizzled," and according to his description, which is borne out by the figure, the legs were much browner—at all events, externally.

The genera and species above described and discussed may be distinguished as follows:—

a. Heel of hind foot entirely covered with hair; black stripes mostly broader than pale stripes. GALIDICTIS, Geoffr.

a'. Tail dark, the same tint as the head ...... *fasciatus*, Gmel.

b'. Tail mostly white, only dark basally above.	
*a*². Six broad black stripes; interspaces, belly, and legs paler	*eximius*, nov.
*b*². Eight black stripes, the supero-lateral duplicated; interspaces, belly, and legs darker	*ornatus*, nov.
b. Heel naked; dark stripes narrow, much narrower than interspaces	MUNGOTICTIS, nov
c. Eight conspicuous black-brown stripes, six extending to head; interspaces paler	*vittatus*, Gray.
c'. Ten inconspicuous red-brown stripes, none passing beyond shoulders, the third from above short; interspaces darker, olive-grey.	*substriatus*, nov.

The synonymy of the species referred to *Galidictis* is probably as follows:—

1. *Galidictis fasciatus*, Gmel.

Viverra fasciata, Gmelin = *Viverra striata*, Desmarest; nec *Galidictis striata* of recent authors.

No specimen of this species is known. I have included it in *Galidictis* because of the breadth of the black stripes; but the tail is coloured much as in the species of *Mungotictis* and the hind foot may have been naked to the heel as in that genus.

2. *Galidictis eximius*, nov.

? *Mustela striata*, E. Geoffroy (= *Galidictis striata* of recent authors, in part).

3. *Galidictis ornatus*, nov.

? *Galidictis striata*, I. Geoffroy (= *Galidictis striata* of recent authors, in part).

Note on the Specific Name of the Type-species of Galidia.

Is. Geoffroy St. Hilaire (Mag. de Zool. 1839, p. 27) identified, and apparently with good reason, the "Voudsire" of Flacourt (Hist. Madag. 1661, p. 154) with *Galidia elegans*, and incidentally pointed out that the "Vansire" of Buffon and Daubenton was a different animal, though possibly belonging to the same genus.

The name *elegans* was accepted as the specific title of the type of *Galidia* until 1908, when Thomas and Wroughton (P. Z. S. 1908, p. 167) proposed to substitute *galera* for it, on the grounds that the Vansire of Buffon and Daubenton, the type of *Mustela galera*, Schreber (Säug. iii. p. 493, pl. cxxxv., 1776), was subsequently described as *G. elegans* by Geoffroy St. Hilaire. Although this view had been considered and rejected by Geoffroy, it was revived interrogatively by Gray and accepted as a certainty by Thomas and Wroughton. I think Geoffroy was right in dismissing the Vansire of Buffon as an indeterminable species. Mivart (P. Z. S. 1882, p. 189) was probably nearer the truth than Gray, Thomas, and Wroughton when he suggested that it might be a species of *Salanoia* (*Hemigalidia*), adding that "had it been *Galidia* the black-ringed tail would surely have been indicated."

The absence of the caudal annuli in Buffon's figure, as well as the description of the general coloration of the Vansire, make it impossible to regard this ambiguous animal as even probably, much less certainly, identical with Geoffroy's *Galidia elegans*. The familiar specific name of this animal must, therefore, in my opinion, be allowed to stand, and the Vansire of Buffon, with *galera* attached to it, be relegated to the limbo of mammalian species unidentifiable at the present time.

EXPLANATION OF PLATE VII.

Fig. 1. *Galidictis eximius*, sp. n.
Fig. 2. *Galidictis ornatus*, sp. n.
Fig. 3. *Mungotictis vittatus*, Gray.
Fig. 4. *Mungotictis substriatus*, sp. n.

XIX.—*On the African Shrews belonging to the Genus* Crocidura.—IV. By Guy Dollman.

[Continued from p. 60.]

Group 8 (*fischeri*).

Size medium. Colour above very pale grey, light cinnamon, or cinnamon-brown, below white or greyish white. Tail incrassated at base. Second and third upper unicuspids about equal in size.

(38) *Crocidura deserti*, Schwann.

Crocidura deserti, Schwann, P. Z. S. p. 103 (1906).

Size as in *hindei*, very pale in colour, paler than *butleri*.

Colour of dorsal surface pale snuff-grey, general effect about as in "light drab," the ground-colour being "light mouse-grey" sprinkled with "light cinnamon-drab," the tint considerably more cinnamon than in *smithi*, but equally pale. Colour on flanks passing fairly abruptly into the white of the ventral surface; hairs of belly with slate-grey bases and white or yellowish-white tips. Lateral gland small, marked by a patch of short white hairs. Backs of hands and feet white. Tail not very long, stoutly built, covered above and below with short white hairs; bristle-hairs fairly numerous, but not very conspicuous, evenly distributed over basal two-thirds. The skins in the Collection show a certain amount of colour-variation, some specimens being rather more strongly tinged with cinnamon, but never as brown as in *butleri*.

Skull about equal in length to that of *hindei*, with a rather larger brain-case. Interorbital region as in *hindei*, not so parallel-sided as in *butleri* or *smithi*. Teeth normal, the small upper unicuspids about equal in size; anterior cusp of large upper premolar not extending past the posterior border of third unicuspid. Last upper molar smaller than in *butleri*.

Dimensions of the type and six adult specimens (measured in the flesh):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂ (type). Molopo	92	16	14	12
♀. "	93	54	14	12
♂. Okwa............	91·5	53	15	11
♂. "	95	53	15	12
♀. "	86	50	14	11·5
♀. "	92	43	14	11·5
♀. "	93	52	14	11

Skull of type: condylo-incisive length 24·9 mm.; greatest breadth 10·3; least interorbital breadth 4·6; length of palate 10·2; postpalatal length 11; greatest maxillary breadth 7·8; median depth of brain-case 5·8; length of upper tooth-row 10·4.

Hab. Molopo River, west of Morokwen, Bechuanaland.

Type. Adult male. B.M. no. 4. 10. 1. 62.

The exceptionally pale colouring immediately distinguishes this Bechuanaland shrew from the allied species. The Somali *smithi*, though equally pale, is more slaty in colour and possesses a smaller and flatter skull, with narrower, more parallel-sided interorbital region, and with the second and third upper unicuspids crushed closely together, the anterior cusp of the large premolar partially concealing the third externally.

(39) *Crocidura butleri*, Thos.

Crocidura butleri, Thomas, Ann. & Mag. Nat. Hist. (8) vol. viii. p. 375 (1911).

A medium-sized pale-coloured species, with short, white, incrassated tail.

Fur rather short, hairs of back about 4 mm. in length.

Colour above grey, washed with pale yellowish cinnamon, general effect as in "drab" mixed with "wood-brown," paler than in any other species excepting *deserti*, *fischeri*, and *smithi*. Flanks greyish washed with yellow. Lateral gland white. Underparts not sharply contrasted with upper, the cinnamon tint gradually fading on the flanks and passing imperceptibly into the creamy-grey of the ventral surface; hairs of belly grey with creamy-white tips. The yellowish tinge on the underparts is possibly due to some secretion from the lateral glands, the areas around which are stained pale lemon-yellow. Backs of hands and feet white. Tail short, very thick and blunt, white above and below; bristle-hairs long and fairly numerous, but rather inconspicuous.

Skull smaller than in *hindei*, with narrower, more parallel-sided, interorbital region; brain-case rather flatter. Teeth similar in shape but slightly smaller, small upper unicuspids about equal in size, cusp of second rather longer than that of third.

Dimensions of the type (measured in the flesh):—

Head and body 78 mm.; tail 34; hind foot 13; ear 10.

Skull: condylo-incisive length 23·9; greatest breadth 10; least interorbital breadth 4·3; length of palate 9·9; postpalatal length 10·9; greatest maxillary breadth 7·5; depth of brain-case 5·3; length of upper tooth-row 10·4.

Hab. Between Chakchak and Dem Zubeir, Bahr-el-Ghazal.

Type. Adult male. B.M. no. 8. 4. 2. 10.

This species is at once recognized by its pale colour and short incrassated tail.

(40) *Crocidura percivali*, sp. n.

Related to *butleri*, but distinguished by its much darker colour, longer tail, and smaller teeth.

Colour above dull cinnamon-brown, between "Prout's brown" and "raw umber," gradually paling on the flanks and passing rather imperceptibly into the greyish white of the belly; hairs of underparts with slaty bases and greyish-white or buff tips. Lateral gland conspicuously marked by a streak of short white hairs. Both above and below this shrew is considerably darker than *butleri*, resembling more the Charnia River species, *beta*, described above, but with less definition between the brown upper parts and greyish-white belly. Backs of hands and feet dirty white. Tail very thick at base, longer than in *butleri*, brownish above, white below; bristle-hairs not numerous, white.

Skull a little smaller than that of *butleri*. Tooth-row shorter, teeth rather narrower, the second and third upper unicuspids smaller and more oval in transverse section, third slightly overlapping second, but not so crushed together as in *smithi* nor hidden externally by the anterior cusp of the large premolar.

Dimensions of the type (measured in the flesh):—

Head and body 84 mm.; tail 47; hind foot 12·5; ear 11.

Skull (brain-case broken): length of palate 9; least interorbital breadth 4·2; greatest maxillary breadth 7·4; length of upper tooth-row 9·2.

Hab. Jombeni Range, Nyeri District, British East Africa. Altitude 3500 feet.

Type. Adult male. B.M. no. 12.7.1.61. Original number 875. Collected on October 8th, 1911, by A. Blayney Percival, Esq., and presented by him to the National Collection.

The longer tail, darker colour, and smaller teeth separate this species from the Bahr-el-Ghazal *butleri*.

It is with pleasure that I name this new form after Mr. Blayney Percival, the collector and donor, to whose generosity the Museum is greatly indebted.

(41) *Crocidura fischeri*, Pag.

Crocidura fischeri, Pagenstecher, Jahrb. Wiss. Anst. Hamburg, p. 34 (1885).

A pale grey-coloured species, with white extremities and tail.

Size medium, tail rather short.

Colour above slaty grey washed with pale brown, near "mouse-grey," rather darker than in *smithi*. Underparts and extremities white. Tail fairly thick, whitish, a trifle darker on the dorsal surface.

Skull much larger than in the allied species, small upper unicuspids crushed together almost as much as in *smithi*, the anterior cusp of the large upper premolar partially hiding the third upper unicuspid when viewed laterally, second and third upper unicuspids about equal in size.

Dimensions of the type (as given by Pagenstecher) :—

Head and body 92 mm.; tail 48.

Skull : length 26 mm.

Hab. Nguruman, German East Africa.

The only specimen of *fischeri* in the Museum Collection is too young to be of any use for systematic work.

This species is evidently a close ally of *smithi*, from which it may be distinguished by its rather darker colour and larger skull.

(42) *Crocidura voi*, Osg.

Crocidura voi, Osgood, Field Mus. Nat. Hist. Publication 143 (Zool. Ser.), vol. x. no. 3, p. 18 (1910).

A pale grey-coloured shrew, with light underparts, closely allied to *fischeri*.

Size about as in *fischeri*.

Colour of dorsal surface described as "slaty"; underparts "dull yellowish or greyish white below, the light and dark areas quite sharply contrasted." Backs of hands and feet white. The colour is therefore very like that of *fischeri*, the underparts not quite so white and the dorsal surface not tinted with pale brownish.

Skull "long and narrow"; teeth large.

Dimensions of the type (as given by Osgood) :—

Head and body 90 mm.; tail 46; hind foot 14.5.

Skull: greatest length 24.2; greatest breadth 9.7; maxillary width 8.2; length of upper tooth-row 11.

Hab. Voi, British East Africa.

Type. Adult male. Field Mus. Nat. Hist. no. 16942.

This species is evidently closely allied to *fischeri*, from which it is distinguished by its rather smaller skull, greyer dorsal surface, and duller underparts.

(43) *Crocidura suahelæ*, Hell.

Crocidura suahelæ, Heller, Smith. Misc. Coll. vol. lx. no. 12, p. 6 (1912).

Allied to *voi*, but distinguished by its larger size and browner colour.

Size rather larger than in *fischeri*.

Colour above "uniform broccoli-brown, not sharply defined against the drab-grey of the underparts; hair everywhere slate-grey at base; lateral glands defined by a conspicuous line of white hairs; feet somewhat lighter than body, drab in colour; tail uniform in colour with the dorsum and clothed by short brown hair and scattered long white hairs on the basal two-thirds."

Dental characters the same as in *voi*, the unicuspids crushed together.

Dimensions of the type (as given by Heller) :—

Head and body 110 mm. ; tail 69 ; hind foot 16.

Skull : condylo-incisive length 26·5 ; greatest breadth 10·5 ; interorbital width 4·8 ; length of upper tooth-row 11·8.

Hab. Mazeras, British East Africa.

Type. Adult male. U.S. Nat. Mus. no. 181815.

The larger dimensions and browner colour distinguish this shrew from the Voi species. *Crocidura fischeri*, although possessing a skull nearly equal in length, has a much shorter tail and lighter underparts.

(14) *Crocidura smithi*, Thos.

Crocidura smithi, Thomas, Ann. & Mag. Nat. Hist. (6) vol. xvi. p. 51 (1895).

This form is distinguished at once by its very pale smoke-grey upperparts, white flanks, limbs, belly, and tail, and flat skull.

Size medium, hind foot from 11 to 12·5 mm. in length. Fur rather short, hairs of back 3 to 4 mm. in length.

Colour pale smoke-grey above, faintly tinged with pale cinnamon, the general effect about as in "pale neutral grey" sprinkled with "light drab." Flanks almost pure white, the grey hair-bases considerably less evident than on the back. Belly white, hairs white almost to the roots, only the extreme bases pale grey. Lateral gland small, marked by a streak of short white hairs. Backs of hands and feet white. Tail rather short, covered with short white hairs above and below ; bristle-hairs fairly numerous, evenly distributed over nearly the whole length of the tail, white in colour, but very slender and inconspicuous.

Skull smaller than in *fischeri*, brain-case very flat, recalling the flattened skulls of the *hildegardeæ* group ; interorbital region more parallel-sided than in *hindei*, the posterior interorbital breadth rather narrower than usual. Teeth fairly large, especially the second upper incisors ; small upper unicuspids crushed closely together, the third partially hidden externally by the small anterior cusp of the large premolar, the cusp of the second is slightly longer vertically than that of the third, but otherwise the two teeth are almost equal in size. Last upper molar small and narrow.

Dimensions of the type (in spirit) :—

Head and body 64 mm. ; tail 31 ; hind foot 11 ; ear 7·5.

Skull : condylo-incisive length 20·8 ; greatest breadth 9 ;

least interorbital breadth 3·8; length of palate 8·6; postpalatal length 9; greatest maxillary breadth 6·7; median depth of brain-case 4; length of upper tooth-row 9·4.

Hab. Webi Shebeli, Somaliland.

Type. Adult male. B.M. no. 96. 8. 1. 1.

In the Collection is a further specimen of this striking species, obtained by Dr. Drake-Brockman at Armaleh, Somaliland; from this individual the colour-description given above has been taken, the type being preserved in spirit. A curious feature in connection with this skin is the extensive brownish staining on the flanks just above and below the lateral glands. The dimensions are rather greater than those of the type:—Head and body 66 mm.; tail 50; hind foot 12·5.

Group 9 (*turba* and *poensis*).

Size medium Colour above blackish brown or dark reddish brown, below grey or brownish grey. Second and third upper unicuspids about equal in breadth.

(45) *Crocidura turba*, Dollm.

Crocidura turba, Dollman, Ann. & Mag. Nat. Hist. (8) vol. v. p. 176 (1910).

A medium-sized, very dark-coloured species, with hairy tail.

Size of hind foot between 14 and 15·5 mm. in length; tail about 48 mm. long.

General colour of dorsal surface dark seal-brown ("fuscous" or "fuscous black" sprinkled with "mummy-brown"), slightly paler on the flanks; hairs of back slate-grey, with long dark brown tips. Ventral surface silvery grey; hairs dark slate-coloured, with greyish-white tips. Backs of hands and feet brownish. Tail covered with short dark hairs, ventral surface usually rather lighter; caudal bristle-hairs grey in colour and fairly numerous.

Skull in general build less delicate than in the *fumosa* group; longer than in *fumosa* or *monax*, with narrow, rather high brain-case and long muzzle, considerably longer than in either *fumosa* or *monax*. Maxillary region, although not broad, more expanded than in *fumosa*. Cranial ridges more developed, the lambdoidal and sagittal sutures meeting further back than in *fumosa*, in which species the sutures are never raised up into prominent ridges, the skull even in old specimens being remarkably smooth, and the lambdoidal suture running considerably further forward before meeting the sagittal suture. Tooth-row fairly long, second and third upper unicuspids narrow, oval in section, about equal in size, and the third slightly overlapping the second; cingula fairly well developed. In *fumosa* these teeth are very different, being broader, circular in section, and the third considerably larger than the second. Last upper molar smaller than in the *dolichura* or *fumosa* groups.

Dimensions of the type and three other specimens from the type-locality and adjacent districts:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂ (type). Lake Bangweolo ..	96	48	15	10
♀. ,, ,, ..	91	47	15·5	10
♂. Kalungwisi	75	44	11	10
Chimpili Plateau	87·5	50	14·5	10

Skull-dimensions of type and another specimen from Northern Rhodesia:—

	♂ (type). mm.	♂. mm.
Condylo-incisive length	24	23·8
Greatest breadth	10	9·7
Least interorbital breadth	4·9	4·8
Length of palate	10	9·6
Postpalatal length	10·9	10·4
Greatest maxillary breadth	7	7
Length of upper tooth-row.......	10·1	10·1

Hab. Chilui Island, Lake Bangweolo. Altitude 3900 feet.

Type. Adult male. B.M. no. 9. 12. 4. 17.

(16) *Crocidura turba zaodon*, Osg.

Crocidura turba zaodon, Osgood, Field Mus. Nat. Hist. Publication 143 (Zool. Ser.), vol. x. no. 3, p. 21 (1910).

In size slightly larger than *turba*, darker in colour and with longer tail.

Tail about 60 mm. in length.

Colour of upperparts rich seal-brown ("fuscous" mixed with "olive-brown"); ventral surface browner, not silvery grey. Backs of hands and feet blackish brown. Tail long, blackish brown, sometimes rather paler below; caudal bristles grey in colour and conspicuous.

Skull a little larger, with heavier teeth.

Dimensions of the type (as given by Osgood):—

Head and body 98 mm.; tail 60; hind foot (c. u.) 18; ear 9.

Average measurements of ten topotypes :—

Head and body 99 (89–110) mm. ; tail 60 (56–65) ; hind foot (c. u.) 17 (16·5–18).

Skull of type: condylo-incisive length 24·3 ; greatest breadth 10·4 ; maxillary breadth 7·4 ; length of upper tooth-row 10·65.

A specimen in the Museum Collection from the Amala River has the following cranial dimensions :—Condylo-incisive length 21·7 mm. ; greatest breadth 10·2 ; least interorbital breadth 5·1 ; length of palate 10·3 ; postpalatal length 10·9 ; greatest maxillary breadth 7·5 ; length of upper tooth-row 10·7.

Hab. Nairobi, British East Africa.

Type. Adult male. Field Mus. Nat. Hist. no. 16929.

The darker colour and longer tail readily separate this East-African form from the Rhodesian *turba*.

(47) *Crocidura turba lakiundæ*, Hell.

Crocidura turba lakiundæ, Heller, Smith. Misc. Coll. vol. lx no. 12, p. 6 (1912).

General proportions as in *zaodon*, but browner in colour.

Tail longer than in *turba* or *provocax*, equalling that of *zaodon*.

General colour of dorsal surface uniform vandyke-brown, underparts but slightly lighter, brownish, not grey. Tail and feet as in *zaodon*.

Skull slightly shorter than that of *zaodon*, smaller than in the average *provocax*.

Dimensions of the type (measured in the flesh) :—

Head and body 95 mm. ; tail 57 ; hind foot 15·5.

Skull : condylo-incisive length 22 ; greatest breadth 10 ; length of upper tooth-row 10·1.

Hab. Lakiundu River, near its junction with the Northern Guaso Nyiro, British East Africa.

Type. Adult female. U.S. Nat. Mus. no. 181816.

In the Museum Collection are three specimens which probably represent this race, one from the Northern Guaso Nyiro in the unbleached pelage and two from the Jombeni Range (Nyeri District, B.E.A.) in the old reddish-brown coat. The skin-dimensions of these three specimens are recorded as follows :—

	♀. N. Guaso Nyiro. mm.	♀. Jombeni. mm.	♀. Jombeni. mm.
Head and body	87	88	86
Tail	55	50	63
Hind foot..	15·5	14	15

There seems little doubt that this race is very close to the Nairobi one, differing only in the rather browner tint of the pelage and slightly smaller skull.

(48) *Crocidura turba provocax*, Thos.

Crocidura turba provocax, Thomas, Ann. & Mag. Nat. Hist. (8) vol. vi. p. 112 (1910).

Allied to *zaodon*, but with shorter tail, about equal to that of *turba*.

Size of body and hind foot as in *turba*.

Colour of dorsal surface slightly darker than in the Rhodesian form, more as in *zaodon*, dark blackish brown ("fuscous" mixed with black), finely speckled with silvery and yellowish grey; ventral surface considerably browner, without the distinct silver-grey wash found in *turba*. Backs of hands and feet dirty brown. Tail as short as in *turba*, dark blackish brown above, a shade lighter below; caudal bristles fairly numerous, light grey in colour.

Skull rather broader than that of *turba*, but exactly the same in general build, the sagittal and lambdoidal sutures meeting in quite the same manner. Teeth slightly heavier, the large second incisor not so long horizontally.

Dimensions of the type and seven other specimens from the type-locality (measured in the flesh):—

	♂ (type). mm.	♂. mm.	♂. mm.	♂. mm.	♂. mm.	♀. mm.	♀. mm.	♀. mm.
Head and body ..	96	90	101	87	96	85	92	93
Tail	51	49	49	45	49	48	..	49
Hind foot	15·5	14·5	15·5	15·5	15·5	15·5	14·5	15·5
Ear	10·5	8·5	8·5	10·5	10·5	10	9·5	9·5

Skull: dimensions of the type and five other adults:—

	♂ (type). mm.	♂. mm.	♂. mm.	♀. mm.	♀. mm.	♀. mm.
Condylo-incisive length	24·2	23·6	24	24·2	24·5	23·8
Greatest breadth	10·3	10·2	10·1	10·1	9·9	10·2
Least interorbital breadth	3	5	5	4·8	5	4·9
Length of palate	9·8	9·8	10	10·2	10·2	9·6
Postpalatal length..............	10·6	10·4	10·5	10·4	10·9	10·8
Greatest maxillary breadth	7·6	7·4	7·3	7·4	7·5	7·4
Length of upper tooth-row	10·4	10·3	10·5	10·5	10·6	10·1

The sexes in *provocax* would not appear to differ from each other as regards size.

Hab. Aberdare Mts., British East Africa. Altitude 11,000 feet.

Type. Adult male. B.M. no. 10. 5. 3. 25.

From *zaodon* this Aberdare race may be distinguished by its shorter tail; the rather darker colour, brownish belly, and light speckling on the back are the chief colour-differences which separate *provocax* from true *turba.*

(49) *Crocidura turba kempi*, subsp. n.

Closely allied to *provocax*, paler in colour and with smaller teeth.

General proportions as in *provocax.*

General colour olive-brown ("olive-brown"), lighter than in the Aberdare race and not exhibiting the silvery-grey speckling to such a marked extent; ventral surface greyer ("neutral grey"), more as in true *turba.* Extremities and tail similar to those of *provocax.*

Skull rather smaller than that of *provocax*, *zaodon*, or *lakundæ*; narrower and with rather smaller teeth, more as in *turba.*

Dimensions of the type and four other specimens (measured in the flesh):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂	94	50	15	9
♀	100	55	15	9
♀	89	53	15	10·5
♀	88	56	15·5	10·5

Skull: dimensions of type and three adults:—

	♂ (type). mm.	♂. mm.	♀. mm.	♀. mm.
Condylo incisive length ...	22·1	22·7	23·4	22·3
Greatest breadth	9·5	9·5	9·7	9·6
Least interorbital breadth	4·9	4·9	4·9	4·7
Length of palate	9·5	9·3	9·8	9·8
Postpalatal length	9·7	10·5	10·5	9·8
Greatest maxillary breadth ..	7·1	7·2	7·4	7·1
Length of upper tooth-row	9·5	9·8	10·2	10·1

Hab. Kirui, Mt. Elgon. Altitude 6000 feet.

Type. Adult male. B.M. no. 10. 4. 1. 40. Original number 290. Collected on September 17th, 1909, by Mr. R. Kemp, and presented by C. D. Rudd, Esq.

Mr. Kemp collected in all six specimens of this Elgon race at altitudes of from 5000 to 6000 feet.

The rather paler colour, absence of prominent silver-grey speckling, and slightly smaller skull seem to indicate that this Elgon shrew should be considered as distinct from the Aberdare race.

(50) *Crocidura turba tarella*, subsp. n.

Allied to *provocax*, rather greyer in colour, with much more prominent silver speckling and slightly heavier teeth.

Proportions of body as in *provocax*, tail rather longer.

General colour dark brownish grey (between "fuscous" and "sepia"); silver-grey or buff speckling very conspicuous both on back and flanks. Underparts more silvery than in *provocax*. Hands and feet, as in most of the *turba* group, brownish, the outer sides of the extremities darker than the inner. Tail rather longer than in *provocax*, of the same colour.

Skull larger than that of *turba*, with heavier teeth; compared with *provocax* the skull appears of very much the same size, the teeth slightly larger.

Dimensions of type and seven other adult specimens :—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂ (type)	91	57	17	9·5
♂	95	50	15	10
♀	84	53	15	9
♀	100	56	17	10
♀	94	55	15·5	8
♀	81	51	15·5	9·5
♀	89	56	16	9
♀	100	58	15·5	9·5

Skull: dimensions of type and three other adult specimens :—

	♂ (type). mm.	♂. mm.	♀. mm.	♀. mm.
Condylo-incisive length	24·5	24·3	24·1	24·5
Greatest breadth	10·4	9·9	10·5	10·3
Least interorbital breadth	5	4·9	5	4·7
Length of palate	10·1	10·2	9·7	10·1
Postpalatal length	10·9	10·4	10·8	10·9
Greatest maxillary breadth	7·6	7·5	7·5	7·4
Length of upper tooth-row	10·9	10·8	10·3	10·6

Hab. Chaya, near Ruchuru, Congo Belge.

Type. Adult male. B.M. no. 11. 12. 3. 52. Original number 2286. Collected by Mr. R. Kemp on June 19th, 1911.

This race would seem to be fairly well distributed over Southern Uganda and the adjoining Congo districts. Mr. Kemp obtained it at the following localities:—Kiduha (Lake Mutanda), Kagambah, Kigezi, Nalasanji, and Mbarara (Uganda), and at the type-locality.

The greyer colour and more abundant silver-grey speckling and lighter underparts are the chief external characters that serve to distinguish this race from the Aberdare *provocax*. The Rhodesian *turba* is still more easily distinguished, as in that form there is hardly any light grey speckling and the teeth are considerably smaller and tail shorter.

(51) *Crocidura turba angolæ*, subsp. n.

A very dark shrew, almost black.

Size rather smaller than in *turba*, tail shorter. Fur fairly long, hairs on back 6·8 mm. in length.

General colour very dark, darker than in any other African *Crocidura*, near "fuscous black" mixed with "black." Flanks slightly paler, the colour gradually becoming greyer towards the ventral surface, belly much as in *turba* ("smoke-grey"), with a silvery streak down the midline. Backs of hands and feet dark brown. Tail short and thickly haired, dark blackish brown above, below slightly paler near the base; bristle-hairs dark, with greyish tips, very numerous.

Skull and teeth much as in *turba*.

Dimensions of the type (measured from dry skin):—

Head and body 80 mm.; tail 32; hind foot 12·5.

Skull (occipital region broken): least interorbital breadth 4; greatest maxillary breadth 7; length of palate 9·3; length of upper tooth-row 10.

Hab. Bailundu Country, Angola.

Type. Adult female. B.M. no. 5. 10. 1. 4. Original number 8. Collected by Mr. C. H. Pemberton, and presented to the British Museum by the Hon. Walter Rothschild, F.R.S.

The darker colour and shorter tail readily distinguish this Angolan shrew from the rest of the *turba* group.

(52) *Crocidura turba mutesæ*, Hell.

Crocidura mutesæ, Heller, Smith. Misc. Coll. vol. lvi. no. 15, p. 3 (1910).

Most nearly allied to the foregoing race, rather larger, with heavier teeth, and brownish in colour.

Size of body rather large, tail as long as in *zaodon*.

General colour of upper parts "mummy-brown," feet and tail darker seal-brown; ventral surface greyish, with a wash of broccoli-brown. Lateral glands rather more distinct than in the other races, marked by a narrow streak of short, light brownish hairs.

Dimensions of type (as given by Heller):—

Head and body 115 mm.; tail 64; hind foot 16 (measured dry).

Skull: condylo-incisive length 25·5; greatest breadth 11·2; length of upper tooth-row 11·3.

Hab. Kampala, Uganda.

Type. Adult female. U.S. Nat. Mus. no. 174636.

The larger skull and teeth, rather longer tail, and more brownish coloration distinguish this Kampala race from *t. tarella.* The only specimen in the Museum Collection which appears to be *mutesæ* comes from Entebbe; it agrees quite closely with Heller's description of the general colour, but is rather smaller.

(53) *Crocidura nilotica*, Hell.

Crocidura nilotica, Heller, Smith. Misc. Coll. vol. lvi. no. 15, p. 3 (1910).

A dark clove-brown form with short tail and small teeth.

Size of body about as in *t. provocax*; tail as short as in *turba.* Pelage not quite so long as in *t. provocax.* Colour of upper parts dark clove-brown, underparts slaty brown, but little higher than back. Feet and tail coloured like rest of dorsal surface, caudal bristles light brown.

Skull a little smaller than in *t. provocax*, with smaller teeth.

Dimensions of type (as given by Heller):—

Head and body 92 mm.; tail 48; hind foot 14·5.

Skull: condylo-incisive length 23; greatest breadth 10; length of upper tooth-row 9·5.

Hab. Lado Enclave.

Type. Adult female. U.S. Nat. Mus. no. 164638.

In his account of this species Heller mentions that further specimens were obtained at Butiaba, Hoima, and Kabula Muliro, in Uganda. There seems little doubt but that *nilotica* is a very close ally of the *turba* group.

(54) *Crocidura zena*, sp. n.

Larger than *turba*, with much larger hind feet and tail.

General colour rather darker than that of *turba* (between "fuscous black" and "aniline-black"), ventral surface browner, the hair-tips brown or grey. Hands and feet very large, strikingly darker on their outer sides and two outer digits *. Tail considerably longer than that of *turba*, dark blackish brown above, below a shade lighter; caudal bristles not so numerous.

The skull is unfortunately badly broken, the brain-case being entirely destroyed; teeth heavier than in *turba*, third upper unicuspid broader and more circular in section, last upper molar larger.

Dimensions of the type (measured in the flesh):—

Head and body 94 mm.; tail 63·5; hind foot 17; ear 10.

Skull: least interorbital breadth 5; length of palate 10·1; greatest maxillary breadth 7·2; length of upper tooth-row 10·6.

Hab. Chilui Island, Lake Bangweolo.

Type. Adult male. B.M. no. 9. 12. 4. 21. Original number 142. Collected by S. A. Neave, Esq.

This shrew was found by Mr. Neave on the same island upon which he obtained the type of *turba*; the great difference in the size of the hind feet and the length of the tail clearly show that these two specimens cannot represent the same species, and it thus becomes necessary to bestow a specific name upon the larger specimen. In general proportions of body and tail this shrew might easily be confused with some of the British East African forms of *turba*.

(55) *Crocidura ansorgei*, sp. n.

Intermediate between the *turba* and *poensis* groups.

Size slightly larger than in *turba*, about equal to *zena* or *soricoides*. Fur as in *turba*.

Colour above considerably paler and greyer than in either *turba* or *poensis*, about like "olive-brown" mixed with "mummy-brown"; flanks a trifle lighter, the brownish tint gradually fading and merging imperceptibly into the dull greyish brown ("deep neutral grey" washed with "light drab") of the ventral surface; hairs of belly slate-grey with pale brownish tips. Backs of hands and feet brownish white. Tail long, more finely haired than in *turba*, more as in *soricoides*, slate-brown above, paler below; bristle-hairs slender and fairly numerous on the basal half, but not nearly so conspicuous as in *turba*.

Skull a trifle smaller and narrower than that of *soricoides*, shape of brain-case more as in *turba*, but muzzle rather blunter. Teeth like those of the Bangweolo species, second and third upper unicuspids a trifle broader and shorter.

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* This feature, although present in some of the races of *turba*, is never so conspicuous as in *zena*.

Dimensions of the type (measured in the flesh) :—

Head and body 98 mm. ; tail 59 ; hind foot (measured dry) 16 ; ear 8.

Skull of type and a male specimen from Benguella: condylo-incisive length 23·9, 23·7 ; greatest breadth 10, 10: least interorbital breadth 4·9, 4·6 ; length of palate 10, 10; postpalatal length 11, 10·6 ; greatest maxillary breadth 7·3, 7·5 ; median depth of brain-case 5·9, 6 ; length of upper tooth-row 10·6, 10·5.

Hab. Duque de Braganca, Angola.

Type. Adult female. B.M. no. 4. 4. 9. 29. Original number 156. Collected by the late Dr. W. J. Ansorge.

There is a second specimen of this new shrew in the collection, the skull-dimensions of which are given above. It agrees fairly closely with the type in general body-measurements (head and body 85 mm.; tail 65 ; hind foot 16·5 ; ear 10).

The exact affinities of this species are somewhat difficult to decide; for the present it seems most convenient to regard it as intermediate between the *turba* and *poensis* groups. From *turba* it is distinguished by its paler colour, longer, less hairy tail, and rather larger hind feet; *zena*, the other Bangweolo species, is very much darker in colour, both above and below. *Crocidura p. soricoides* possesses a larger skull, broader and flatter brain-case, and is considerably browner in colour. *Crocidura nigricans*, from Angola, is a much smaller animal (head and body 70 mm.; tail 52; hind foot 12).

(56) *Crocidura poensis*, Fraser.

Sorex (Crocidura) poensis, Fraser, P. Z. S. p. 200 (1842).

A medium-sized, dark brown-coloured species.

The upper parts are described as "of a deep brown colour, rather indistinctly variegated with greyish"; the body beneath is "grey, but slightly washed, as it were, with dirty yellow." In the Museum Collection there are four specimens from Fernando Po which may be accepted as representing Fraser's species; the colour of the new unworn pelage is considerably greyer than in the bleached phase, about as in "fuscous"; in the bleached state the coat is much browner and redder, near "Prout's brown." Flanks rather greyer, the brownish tint gradually passing into the grey of the belly. Ventral surface pale slaty grey ("neutral grey"); in the worn coat the colour of the belly is considerably browner ("neutral grey" suffused with "drab").

Backs of hands and feet more markedly bicolour than in any of the East African forms (excepting *zena*), outer sides dark sepia, inner portions reddish brown. Tail fairly long and finely haired, dark brown above, a trifle paler below; bristle-hairs numerous, but not very conspicuous.

Skull rather short with blunt muzzle; brain-case broad and a little flattened, but not markedly so. Teeth all rather heavy, third upper unicuspid slightly larger than and overlapping second.

Dimensions of the type (as given by Fraser):—

Head and body 3 in. 3 lin.; tail 1 in. 10 lin.; hind foot 6 lin.

The Museum specimens show rather greater measurements for the hind feet:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂	86	53	15	11
♀	76	48	15	10

Skull of female specimen: condylo-incisive length 22·9; greadth breadth 9·8; least interorbital breadth 4·7; length of palate 10; postpalatal length 10·5; greatest maxillary breadth 7·2; median depth of brain-case 5·4; length of upper tooth-row 10.

In another specimen the tooth-row measures 10·6 mm. in length.

Hab. Clarence, Fernando Po.

(57) *Crocidura poensis soricoides*, Murray.

Rhinomus soricoides, Murray, Proc. Roy. Phys. Soc. Edinb. p. 159 (1859-60).

Closely allied to *poensis*, but distinguished by its larger skull.

Murray's type, which is preserved in the British Museum, is unfortunately in a very faded condition; it is evident, however, that the colour was very similar to that of *poensis*. A more recently collected specimen from Agberi, Southern Nigeria, may be taken as representing this form; the colour above is dark vandyke-brown ("clove-brown" mixed with "mummy-brown'), profusely sprinkled with golden buff, the flanks a trifle greyer and speckled with silver, the colour fading gradually into the greyish brown of the belly. Backs of hands and feet brown. Tail as in *poensis*.

Skull larger, with larger, more parallel-sided brain-case. Teeth all larger; third upper unicuspid slightly broader than second, and overlapping it, as in *poensis*.

Approximate dimensions of the type (taken from dry skin):—

Head and body 75 mm.; tail 59; hind foot 15.

Dimensions of three spirit-specimens:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♀. Lagos	80	61	16
♀. Old Calabar	80	50	14·2
♀. Niger	79	61	15

Skull of type (broken) and topotype (♀): condylo-incisive length —, 25; greatest breadth —, 10; least interorbital breadth 4·8, 4·3; length of palate 10·4, 10·6; post-palatal length —, 11·3; greatest maxillary breadth 7·2, 7·7; median depth of brain-case —, 5·7; length of upper tooth-row 11, 11.

Hab. Old Calabar, Southern Nigeria.

Type. Adult. B.M. no. 63. 12. 17. 6.

The larger size of the skull separates this mainland form from Fraser's *poensis*.

(58) *Crocidura poensis attila*, subsp. n.

Smaller than *soricoides* or *poensis*, with lighter under surface more distinctly marked off from dorsum.

Size rather smaller than the Fernando Po specimens in the Collection.

Colour of new coat dark sepia-brown above, near "fuscous" mixed with "clove-brown"; slightly paler on the flanks, the colour passing rather abruptly into the pale greyish tint of the ventral surface ("light neutral grey" mixed with "light drab"). In the worn phase the coat is rather redder in colour ("bistre"). Lateral gland silvery white. Extremities as in *poensis*. Tail dark sepia-brown above, paler below, clothed in very fine hairs, appearing almost naked except for the bristle-hairs which are fairly numerous and greyish in colour.

Skull smaller than that of *poensis* or *soricoides*, with narrower brain-case and muzzle. Teeth conspicuously smaller, third upper unicuspid a little broader than second, and slightly overlapping it.

Dimensions of the type and three topotypes (measured in the flesh):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂. (Type) .	80	48	14	10
♂	90	55	14	11
♀	80	50	12	10
♀	80	45	13	10

Skull-dimensions of type and paratype (♂): condylo-incisive length 21, 21·7; greatest breadth 9, 9·3; least interorbital breadth 4·3, 4·5; length of palate 8·9, 9·2; postpalatal length 9·1, 9·5; greatest maxillary breadth 6·8, 6·7; median depth of brain-case 4·9, 5; length of upper tooth-row 9·1, 9·4.

Hab. Bitye, South Cameroons. Altitude 2000 feet.

Type. Adult male. B.M. no. 14. 7. 23. 9. Original number 713. Collected by Mr. G. L. Bates on December 3rd, 1913.

The smaller-sized skull, smaller teeth, and lighter ventral surface distinguish this Cameroon race from both *poensis* and *soricoides*.

(59) *Crocidura poensis pamela*, subsp. n.

Size about as in *poensis*, tail shorter, and colour considerably duller.

General colour of dorsal surface dull brown ("olive-brown"), very thickly sprinkled with golden buff. Flanks a little greyer, the brown colour gradually merging into the greyish buff of the ventral surface ("neutral grey" suffused with "drab"). Extremities as in *poensis*. Tail short and appearing almost naked, sparsely clothed in very fine short hairs, blackish above, pale brown below; bristle-hairs very few and inconspicuous, not spreading more than halfway down the tail.

Skull about equal to that of *poensis*; brain-case similar in size, but more angular, suggesting the square-angled cranium of the *luna* group. Teeth as in *poensis*.

Dimensions of the type (measured in the flesh):—

Head and body 83 mm.; tail 35; hind foot 13; ear 8.

Skull: condylo-incisive length 22·7; greatest breadth 10·1; least interorbital breadth ·4·7; length of palate 9·5; postpalatal length 9·7; greatest maxillary breadth 7; median depth of brain-case 5·6; length of upper tooth-row 10.

Hab. Bibianaha, Gold Coast.

Type. Adult male. B.M. no. 11. 1. 11. 3. Original number 35. Collected on December 11th, 1910, by Dr. H. G. F. Spurrell and presented by him to the National Collection.

A specimen presented by F. Russell Roberts, Esq., collected in the French Gambia, appears also to belong to this form; the colour is very like that of the type and the general dimensions much the same, the tail-measurement being 40 mm.

The duller colour and shorter tail distinguish this race from *poensis*, *soricoides*, and *attila*.

(60) *Crocidura batesi*, sp. n.

In size rather larger than in *poensis* group, distinguished by its very dark colour, large teeth, and almost naked tail.

Fur about as in *poensis*.

Colour above dark blackish brown, near "fuscous" mixed with "clove-brown" and "blackish brown (1)"; a slight amount of buff speckling visible in certain lights. Ventral surface but very little lighter, "deep neutral grey" washed with "Saccardo's umber." Backs of hands and feet brownish. Tail long and appearing almost naked, clothed with very short, fine, dark hairs, blackish brown above, a shade paler below; bristle-hairs very inconspicuous, a few present on the basal portion only, recalling the condition found more markedly in the *dolichura* group.

Skull larger than in *poensis* or *soricoides*, brain-case considerably higher, but not as large as in *occidentalis*.

Dimensions of the type and a female specimen from the Ja River:—

Head and body 105, 95 mm.; tail 65, 54; hind foot 16, 15; ear 10, 8.

Skull (badly broken): length of palate 10·2; greatest maxillary breadth 8; length of upper tooth-row 12.

Hab. Como River, Gaboon. Sea-level.

Type. Adult male. B.M. no. 97.7.1.4. Original number 168. Collected on March 26th, 1897, by Mr. G. L. Bates.

In the Museum Collection, besides the type and the Ja River specimen mentioned above, there are two subadult individuals, preserved in spirit, from the Benito River (French Congo) and Efulen (Cameroons). All these specimens agree in the scarcity of the caudal bristle-hairs and the darkness of the general colouring.

(61) *Crocidura foxi*, sp. n.

Paler and greyer than *soricoides*.

Size about as in the Calabar species.

Colour of dorsal surface snuff-brown mixed with grey ("drab" speckled with "neutral grey"), considerably greyer and paler than in *soricoides*. In the worn pelage the colour is rather richer ("sepia" speckled with grey and buff). Flanks rather greyer, the brownish tint gradually passing into the dull slate-grey of the ventral surface, which varies in colour from "pale smoke-grey" in the new coat to "light greyish olive" in the worn phase; hairs of belly with slaty bases and greyish-white tips, the general effect paler and greyer than in *soricoides*. Backs of hands and feet brownish. Tail rather more coarsely haired than in *poensis* or *soricoides*, dark brownish black above, rather paler below; bristle-hairs greyish, fairly numerous, and conspicuous.

Skull about equal in size to that of *soricoides*, muzzle rather blunter and brain-case more inflated, shaped more as in the Gold Coast race of *poensis*, described above. Teeth about equal in size to those of *soricoides*, third upper unicuspid rather broader than second, and slightly overlapping it.

Dimensions of the type (measured in the flesh):—

Head and body 98 mm.; tail 61; hind foot 16; ear 12.

Skull: condylo-incisive length 24·8; greatest breadth 10·5; least interorbital breadth 4·8; length of palate 10·8; postpalatal length 10·6; greatest maxillary breadth 7·6; median depth of brain-case 6·2; length of upper tooth-row 11.

Hab. Panyam, Northern Nigeria. Altitude 4000 feet.

Type. Adult male. B.M. no. 11. 3. 24. 7. Original number 5. Collected and presented by the late Rev. G. T. Fox.

A second specimen, a female from the type-locality, agrees very closely with the type in general colour and dimensions.

This shrew is easily distinguished from *soricoides* and the other races of *poensis* by its much paler and greyer colour.

Group 10 (*arethusa* and *erica*).

Size medium. Colour above cold grey washed with cinnamon or brown. Second and third upper unicuspids about equal in size; last upper molar very small.

(62) *Crocidura arethusa*, sp. n.

Smaller than *foxi* and greyer in colour.

Hind foot only 14 mm. in length. Fur rather short, hairs of back 3–4 mm. long.

Colour of dorsal surface pale cinnamon-brown mixed with grey, about as in "mouse-grey" speckled with "mummy-brown; flanks a trifle greyer, the brownish tint passing abruptly into the greyish white of the ventral surface, the demarcation much sharper than in *foxi* or any of the *poensis* group. Underparts considerably lighter, almost white ("pale neutral grey"). Backs of hands and feet dirty white. Tail shorter and more finely haired, drab-brown above, whitish below; bristle-hairs greyish white, very numerous, and conspicuous.

Skull rather smaller and narrower, with flatter and smaller brain-case. Teeth very similar, excepting the last upper molar, which is markedly smaller.

Dimensions of the type (measured in the flesh):—

Head and body 80 mm.; tail 49; hind foot 14; ear 9.

Skull (occipital region broken): basal length 20·7; greatest breadth 9·9; least interorbital breadth 4·1; length of palate 10·2; postpalatal length 10·4; greatest maxillary breadth 7·4; median depth of brain-case 5·1; length of upper tooth-row 10·6.

Hab. Kabwir, Bauchi Province, Northern Nigeria. Altitude 2500 feet.

Type. Adult female. B.M. no. 14. 11. 8. 2. Original number 68. Collected on August 27th, 1914, by Dr. J. C. Fox and presented by him to the British Museum.

The smaller size, paler colour, flatter skull, and smaller last upper molar separate this form from the other North Nigerian species, *foxi*.

(63) *Crocidura erica*, sp. n.

Allied to *arethusa*, but distinguished by its greyer colour, longer, less hairy tail, and flatter skull.

Colour above pale dove-grey faintly washed with brownish cinnamon, the general effect "hair-brown" finely speckled with pale "mummy-brown," greyer and paler than in *arethusa*; flanks somewhat greyer, the brownish tint gradually merging with the dull grey of the underparts; belly duller and greyer than in the Kabwir species, more as in *foxi* (near slate-grey washed with "mouse-grey"). Backs of hands and feet dirty white. Tail long, very finely haired, drab-brown above, dirty white below; bristle-hairs few in number, short and greyish white in colour, confined to basal half of tail.

Skull smaller than in *soricoides* and much flatter, about equal to that of *arethusa*, but with flatter brain-case. Teeth fairly heavy, upper unicuspids large, the second not smaller than the third. Last upper molar as small and narrow as in *arethusa*.

Dimensions of the type (measured in the flesh):—

Head and body 96 mm.; tail 54; hind foot 15; ear 8.

Skull of type and topotype (♀): condylo-incisive length

23·3, 22·4; greatest breadth 10·2, 9·7; least interorbital breadth 4·8, 4·5; length of palate 10, 10; postpalatal length 10·6, 10; greatest maxillary breadth 7·2, 7; median depth of brain-case 4·9, 4·8; length of upper tooth-row 10·3, 10·2.

Hab. Pungo Andongo, Angola. Altitude 3600 feet.

Type. Adult male. B.M. no. 4. 4. 9. 30. Original number 30. Collected by the late Dr. W. J. Ansorge.

This species would appear to be most nearly allied to the Nigerian *arethusa*, agreeing with it in general dental characters, but distinguished by its duller upper parts, darker belly, longer and less hairy tail, and flatter skull. *Crocidura luna*, which this species somewhat resembles in colour, is at once distinguished by its much broader skull, with higher and squarer brain-case, and the larger size of the last upper molar.

[To be continued.]

XX.—*New African Rodents and Insectivores, mostly collected by Dr. C. Christy for the Congo Museum.* By OLDFIELD THOMAS.

(Published by permission of the Trustees of the British Museum.)

DURING the absence of Mr. Dollman in the service of his country I have been entrusted with the examination of the magnificent collection of mammals made by Dr. Cuthbert Christy on the upper waters of the Ituri and Welle during the past two years for the Congo Museum at Tervueren. Although, as might be expected, the majority of the species are similar to those of Ruwenzori and Uganda to the east, and the Cameroons on the west, a certain number are new, and by the kind permission of the Belgian authorities I am authorized to publish short descriptions of them in the 'Annals.' A full list of the collection will, it is hoped, be issued later in the Congo Museum Journal.

Notes on the first instalment of the collection were published last year by Mr. Dollman *.

Funisciurus anerythrus bandarum, subsp. n.

General characters of *F. anerythrus*, but paler, and more such as might be expected in a less heavily forested country. Upper colour, as compared with the "dull greyish olive" of

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* Rev. Zool. Africaine, iv. p. 75.

anerythrus, more approaching a "citrine-drab" hue, the tone deader and less glossy than in the typical form. The dull rufous suffusion across rump and hips, as found in *anerythrus*, practically absent, the legs only slightly more fulvous than the body. Light lateral lines much less conspicuous than in *anerythrus*, tending towards obsolescence. Buffy wash on belly-hairs paler, more creamy and less ochraceous than in *anerythrus*.

Dimensions of type :—

Head and body 202 mm. ; tail 193 ; hind foot 43.

Upper molar series, exclusive of p^3, 7·2.

Hab. Upper Shari River and adjacent parts of R. Ubangui. Type from the Ba-mingui River, Upper Shari. Alt. 2000′. Other specimens from Krebidje, R. Tomi, Ubangui, and St. Esprit Mission, on Ubangui above Kemmo.

Type. Adult female. B.M. no. 7. 7. 8. 89. Original number 23. Collected 10th August, 1905, by Capt. Boyd Alexander on the Alexander-Gosling Expedition. Presented by the Expedition. Six specimens examined.

A paler, less saturate form of *F. anerythrus.* The fine series of true *anerythrus* obtained by Dr. Christy on the Welle for the Tervueren Museum has enabled me to distinguish this Shari subspecies.

Tatera dichrura, sp. n.

T. liodon group.

Similar in size, proportions, general colour, and cranial characters to *T. ruwenzorii*, but the tail prominently contrasted white on its sides and below, while in *T. ruwenzorii* and the allied species *T. dundasi* and *smithii* the underside of the tail is soiled drabby white or even pale brown. Teeth heavier and bullæ rather larger than in *T. valida.* No blackish patch below ear as in the latter.

Dimensions of no. 1455 (type), measured in skin :—

Head and body 175 mm. ; tail 183 ; hind foot 35·7.

Skull : greatest length 43 ; condylo-incisive length 38·1 ; zygomatic breadth 22 ; interorbital breadth 7·2 ; anterior palatal foramina 7·8 ; posterior palatal foramina 1·7 ; upper molar series 6·6.

Hab. Upper Welle R., Congo. Type-locality, Poko.

Taterillus congicus, sp. n.

Near *T. emini*, but much darker-coloured ; the dorsal area specially darkened. Size comparatively large, about equalling the largest of the known species. General colour dark tawny brown, the sides and rump clear tawny, the back tawny brown, darkened by the ends of the hairs being black. Colour of flanks encroaching on the sides of belly, the lateral hairs of the belly being tipped with tawny, and its white area consequently narrowed. Top of muzzle black. Crown tawny brown like back. Hairy band across sole distinct. Tail long, well-tufted, dark brown above, dull drabby or buffy below.

Skull like that of *T. emini*, but slightly larger.

Dimensions of no. 1188 (type), measured in flesh:—

Head and body 135 mm.; tail 170; hind foot 33; ear 20.

Skull: greatest length 36·5; condylo-incisive length 31·2; interorbital breadth 6·6; anterior palatal foramina 6·8; posterior palatal foramina 4·1; upper molar series 5.

Hab. Upper Welle. Typical locality, Poko.

This fine *Taterillus* is readily distinguishable from *T. emini* and *T. nigeriæ*, its nearest allies, by its much darker and more tawny colour, its contrasted dark dorsal area, and the encroachment on the pure white of the belly by the tawny colour of the flanks.

Mylomys alberti, sp. n.

A large species, ochraceous posteriorly, with white underside.

Size large, the skull as large as in the figure given by Heller of his "*Pelomys roosevelti*" *. That figure is said to be of the natural size, but is larger than the dimensions given in the description. General colour above coarsely mixed black and buffy, very much as in *M. lutescens*, but posteriorly the colour becomes ochraceous or rufescent, richest at the base of the tail. Sides paler. Under surface and inner sides of limbs strongly contrasted pure white, the hairs white to their bases. Hands and feet buffy on metapodials, the digits whiter. Tail blackish above, buffy on sides, whiter below.

Skull large and strongly built, with heavy muzzle and strongly developed supraorbital ridges. Molars proportionally rather small, not as large as in the smaller *M. lutescens*.

Dimensions of no. 1231 (the type), measured on the skin:—

Head and body (c.) 170 mm.; tail 170; hind foot 35·5.

Skull: greatest length 38·5; condylo-incisive length 35; zygomatic breadth 18; nasals 15·2; interorbital breadth 5; palatilar length 18·2; palatal foramina 7·6 × 2·6; upper molar series 7·6.

Hab. Poko, Upper Welle.

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* Smiths. Misc. Coll. vol. liv. p. 1, pl. i. (1910).

Two specimens, collected by Dr. C. Christy.

This *Mylomys* is readily distinguished by the large size of its skull and its white underside, the other species all having grey-based belly-hairs.

I have named this handsome species in honour of King Albert I. of Belgium, whose gallant fight against the misfortunes of his country has been the admiration of all the civilized world.

Mylomys lutescens, sp. n.

Size slightly larger than in *M. cuninghamei*. General colour yellowish buffy, heavily lined with black. Rump not prominently more ochraceous or rufous, though there are a few ochraceous hairs just round the base of the tail. Sides slightly greyer. Under surface dull creamy whitish, the basal halves of the hairs slaty. Ears brown, not contrasting with the general colour. Hands pale brownish. Feet buffy on the metatarsals, whiter along the edges and on the digits. Tail blackish above, whitish on sides and below.

Skull of same size as in *M. cuninghamei*; palatal foramina more widely open; bullæ larger.

Molars distinctly larger than in *cuninghamei*, the series very slightly longer, but the teeth decidedly broader and heavier (breadth of m^1 2·6 mm. as compared with 2·3).

Dimensions of the type:—

Head and body 144 mm.; tail 141; hind foot 34; ear 19.

Skull: greatest length 35; condylo-incisive length 31·8; zygomatic breadth 16·2; interorbital breadth 4·7; palatal foramina 7·2 × 3; upper molar series 8.

Hab. S.W. Uganda. Type from Nalasanji. 5000′. Another specimen from Kiduha, Lake Mutanda. 6000′.

Type. Adult female. B.M. no. 11. 12. 3. 353. Original number 2339. Collected 8th July, 1911, by Robin Kemp.

Distinguished from *M. cuninghamei* by its more buffy, less tawny colour, and by the greater breadth of its molars. The difference in tail-length is doubtful, since the tail of the type of *M. cuninghamei*, measured by its discoverer and published by me as 102 mm., was probably longer in reality; in its present state it is certainly imperfect terminally.

Epimys longicaudatus ituricus, subsp. n.

Epimys sebastianus, Dollman, Rev. Zool. Africaine, iv. p. 81 (1914), nec de Wint.

General characters as in the Cameroons *E. longicaudatus* *,

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* *Dasymys longicaudatus*, Tullberg.
Mus sebastianus, de Wint.

When de Winton described his *Mus sebastianus* from the Cameroons but size, as gauged by skull, averaging slightly larger. Colour paler, the flanks especially paler and more hoary grey, and the tail generally more or less whitened beneath in its terminal half. In true *longicaudatus* the tail is uniformly brown throughout.

Dimensions of no. 849 (type), measured in the flesh:—

Head and body 158 mm.; tail 225; hind foot 32; ear 20.

Skull: greatest length 39·2; condylo-incisive length 35·4; zygomatic breadth 18·4; nasals 15; interorbital breadth 5·6; palatal foramina 7·5; upper molar series 6·5.

Localities. Medje, Upper Ituri (type); Pilipili (Makala), Ituri; Fundi, Ituri; and Poko, Upper Welle. Twelve specimens examined.

GRAMMOMYS, gen. nov.

Like *Thamnomys*, but the postero-internal or "*x*" cusp of the first and second molars reduced to a mere connecting-ridge running from the inner cusp of the median lamina to the hinder point of the tooth.

External characters as in *Thamnomys.*

Type. *Grammomys dolichurus* (*Mus dolichurus*, Smuts).

When originally founding the genus *Thamnomys*, I pointed out that it contained two groups of species: (1) the typical *Thamnomys*, with the cusp *x* strongly developed, and (2) these more or less intermediate between *Thamnomys* and *Epimys*, in which this cusp was reduced to a narrow ridge, often hardly perceptible.

With the great increase in the number of known species, I now think it advisable that this intermediate group should have a special name.

To *Thamnomys* proper there only belong the following forms:—*venustus* (type), *rutilans*, *kuru*, and *kempi*; while there go into *Grammomys* the great mass of the known species, including *dolichurus*, *surdaster*, *ruddi*, *baliolus*, *buntingi*, *ibeanus*, *macmillani*, *cometes*, *discolor*, *gigas*, *dryas*, and a few others described as subspecies of these.

Deomys christyi, sp. n.

Size about the same as in *D. ferrugineus.* General colour above paler and more drabby; the ground-colour along the

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he naturally considered the name *longicaudatus* given by Tullberg as antedated by Bennett's *Mus longicaudatus* from S. America. But now that these rats are no longer placed in *Mus*, Tullberg's name, given in conjunction with the incorrect generic term *Dasymys*, becomes again avail nape and sides of the back near "cinnamon-drab" instead of tawny, the blackish median saddle-mark not so drab or so strongly contrasted. Under surface similarly pure sharply defined white. Limbs rather more completely whitish. Tail equally long and pencilled terminally, but, instead of being dark above quite to the tip as in *D. ferrugineus*, the end for from 1 to 3 inches is white above as well as below, forming a white terminal pencil.

Skull generally similar to that of *D. ferrugineus*, but the supraorbital ridges form more distinct postorbital projections, overhanging the temporal fossæ. In *ferrugineus* the ridges are, as a rule, straight, without projections. Palatal foramina averaging shorter. Opening of posterior nares narrower, the median notch of the palate more sharply pointed.

Teeth as in *D. ferrugineus*.

Dimensions of an adult female from Poko, no. 1134 (type), taken on skin:—

Head and body 148 mm.; tail 205; hind foot 35·3.

Skull: greatest length 36·7; condylo-incisive length 32·5; zygomatic breadth 15; nasals 14; interorbital breadth 6; breadth across brain-case 14; palatilar length 16·7; palatal foramina 5·5; upper molar series 5·8.

Hab. Upper Ituri and Upper Welle.

This Eastern representative of the *Deomys ferrugineus* of the Cameroons and Gaboon is readily distinguishable by its duller and paler colour, its white-tipped tail, and the cranial characters above described.

Named in honour of its collector Dr. Christy, who informs me that it is a water-rat living along the edges of the rivers.

Sylvisorex gemmeus irene, subsp. n.

Size, proportions, and cranial characters as in true *gemmeus* of the Lado Enclave, but general colour pale olive-brown.

Dimensions of type (measured in flesh):—

Head and body 60 mm.; tail 68; hind foot 13·5; ear 9.

Skull: condylo-incisive length 17·2; breadth of brain-case 7·8; upper tooth-row 7·4; p^4–m^2 3·8.

Hab. Southern Uganda and Upper Ituri. Type from Kaganbah, Uganda. Alt. 1600 m. Two other specimens obtained by Dr. Christy at Poko, on the Welle, and Medje, on the Upper Ituri.

Type. Adult male. B.M. no. 11. 12. 3. 56. Original number 2344. Collected 10th July, 1911, by Robin Kemp.

The general colour of true *gemmeus* is said to be "seal-brown," a very different colour from the pale olive-brown of this form.

Sylvisorex gemmeus infuscus, subsp. n.

General characters as in true *gemmeus*, but colour of body much darker, near "fuscous" of Ridgway.

Dimensions of type (measured in flesh):—

Head and body 65 mm.; tail 73; hind foot 13·5; ear 8.

Skull: condylo-incisive length 17·5; breadth of brain-case 7·7; upper tooth-series 7·6; p^4–m^2 3·8.

Hab. Bitye, Ja River, S. Cameroons.

Type. Adult male. B.M. no. 13. 9. 12. 4. Original number 642. Collected 17th December, 1912, by G. L. Bates.

Erinaceus algirus caniculus, subsp. n.

Similar in essential characters to true *algirus*, but while *E. a. algirus* of Morocco and Algeria is comparatively dark above and partly or wholly dark below, and *E. a. vagans* of the Balearic Islands (and Spain?) is light above and wholly white below, the present form is even lighter than *vagans* above, but its face and lower surface are partially brown, as in *algirus*.

Spiny area white or cream-white, the dark rings to the spines scarcely showing, their light tips from 5–7 mm. in length. Furry area with the edge bordering the spines brown all along, from the crown backwards along the flanks to the hind limbs. A broad band across the muzzle from cheek to cheek brown. Hands, hinder portion of belly, and whole of hind limbs also brown.

Dimensions of the type, measured in flesh (immature):—

Head and body 190 mm.; tail 27; hind foot 35; ear 30.

Skull: greatest length 51.

Skull of an old female: condylo-basal length 56·5; zygomatic breadth 37; intertemporal constriction 13·8; palatal length 34; upper tooth-series 27·8.

Hab. Eastern Canary Islands. Type from Toston, Fuerteventura.

Type. Immature male. B.M. no. 13. 7. 26. 11. Original number 1. Collected 9th May, 1913, by Mr. D. A. Bannerman.

It is not improbable that hedgehogs from the desert regions of Africa opposite the Canaries will also prove to be this pale form of *E. algirus*.

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XXI.—*On some of the External Characters of the Palm-Civet* (Hemigalus derbyanus, *Gray*) *and its Allies.* By R. I. Pocock, F.R.S., Superintendent of the Zoological Society's Gardens.

[Plate VIII.]

The facts recorded in this paper are based upon an examination of specimens in the British Museum, more particularly upon one of *Hemigalus derbyanus*, a young male preserved in alcohol and collected by C. Hose at Baram, N. Borneo; also upon a skin of that species obtained on Lawes Mt., N. Borneo, by A. Everett, and one of *Diplogale hosei* from Mt. Dulit, collected by C. Hose, both of which were kindly lent to me by Mr. Edward Gerrard.

Coloration.—The peculiar and, in some respects, curiously variable pattern of *Hemigalus* is well known. On the head there is a narrow median dark streak stretching from the rhinarium to the fore part of the nape of the neck, and on each side of this there is a broader dark stripe which encircles the eye and passes backwards over the base of the ear. On the upper side of the neck there are two very broad stripes, sometimes more or less broken up into shorter stripes or spots, which run backwards and curve downwards to the elbow. Behind these and adjacent to the whorl, whence the hairs radiate, are two shorter oblique stripes, also sometimes represented by spots. Behind the shoulders the back is marked by five or four broad transverse stripes separated by pale, usually narrower interspaces. The tail has two inferiorly imperfect stripes at its base, the posterior of these being indistinctly separated from the dark tint which pervades the rest of the organ.

Examination of the pattern in genets and linsangs leaves little doubt as to the mode of origin of this pattern. Large laterally placed spots, originally arranged in longitudinal lines, have coalesced transversely with each other and with the adjacent portion of the spinal stripe, and become isolated into transverse bands by the suppression of the intervening areas of the spinal stripe. This stripe is merely represented by the median portion of the transverse stripes. On the neck it has wholly disappeared, and the two large stripes of this region correspond with the two similar stripes observable in many Viverridæ, especially in some species of *Genetta*. This is the most specialized type of pattern met with in the Viverridæ; and it is interesting to note that it is more easily derivable from the heavily blotched genettine pattern than from that exhibited by any of the Paradoxurinæ, in which the pattern is for the most part partially or wholly suppressed.

Vibrissæ and Rhinarium.—The facial vibrissæ are normal in number of tufts. The mystacials are long, rigid, and numerous; the superciliaries and the two genal tufts on each side consist of a few finer and shorter bristles, those of the interramal tuft being still shorter and finer.

The rhinarium (Pl. VIII. figs. 1, 2, 3) is large and projecting, deeply grooved in front and above, its upper edge, viewed from the front, being biconvex, and viewed from above biangular, the two angular prominences being separated by a wide angular emargination. The infranarial portion, seen from the front, is deep from above downwards, and overlaps the nostrils laterally to a considerable extent, its inferior edge on each side of the middle line being transverse, with rounded lateral angles. A groove extends obliquely downwards and inwards beneath the nostril towards the middle line, and a deep transverse groove cuts off the wide superolateral area which stretches backwards below the narial slits on the upper surface of the rhinarium. These slits converge somewhat posteriorly, and the posterior border of the rhinarium is lightly emarginate.

In its general features the rhinarium resembles that of the Paradoxurine genera, *Paradoxurus* and *Arctogalidia*. From its anterior aspect it is hardly distinguishable from that of *P. larvatus*, but the groove defining the portion of it that extends laterally backwards beneath the narial slit on each side above is deeper than in any genus of this family I have seen, and the portion defined by the groove is wider. The angular emargination of its anterior border when seen from above resembles in width and depth that of *Arctogalidia.*

Ear (Pl. VIII. fig. 4).—The cartilaginous ridges strengthening the lower portion of the pinna generally resemble those of the Viverridæ. The outer of the two anterior ridges (*ae.*) running upwards from the lower orifice of the meatus (*o.*) has a strongly sinuous edge and carries two prominences, the lower of which is the tragus. The inner of these two ridges (*ai.*) also carries two prominences, the lower being angular in profile view and the upper semicircular and turned forwards away from the cavity of the ear. This process clearly corresponds to the angular process which, in other genera of this family hitherto examined by me, projects backwards towards the hollow of the pinna over the anterior end of the supratragus. The supratragus (antihelix) (*s.*) carries the normal lobate thickening. The two posterior ridges (*pe.*, *pi.*) of the cavity of the pinna are developed as in other genera, but there is a very distinct ridge or crest (*e.*) on the outer side of the prominence, called by Mivart the antitragus, as in *Viverricula.* The bursa (*b.*) has its anterior flap deeply and concavely emarginate, the inferior angle of the emargination being prominent and subacute as in *Paradoxurus hermaphroditus.* The posterior flap is semicircular, and its upper margin is attached behind the edge of the pinna as in *Paradoxurus*, *Nandinia*, etc., and is not continuous with it as in *Arctogalidia*, *Civettictis* *, and *Viverricula.*

The Scent-pouch (Pl. VIII. fig. 5).—So far as I am aware, the only description of the scent-gland in this genus is that published in 1882 by Mivart, who examined a female given to him by Mr. A. D. Bartlett. He "found superficial folds something as in *Genetta*—two oblique shallow folds extending obliquely upwards and outwards from near the anus to the vicinity of the vagina. The secretion could be squeezed into these folds, just as in the specimen I examined of *Genetta tigrina*" (P. Z. S. 1882, p. 167).

In the young male example in the British Museum the gland appears to resemble that of the female, but the precise details of its structure could not be determined, without dissection, from the material available. The following points, however, may be noticed. The glandular area (*gl.*) consists of a pair of longitudinal thickenings or ridges of integument extending from the scrotum towards the penis. They are entirely covered with and partially concealed by silky hair. Between them lies in the middle line an elongated suboval depression, shallow behind and gradually deepening in front to form presumably a receptacle for the secretion. This depression does not reach posteriorly as far back as the scrotum (*sc.*), which is quite normal in being undivided—*i. e.*, not like that of *Cynogale* nor so far anteriorly as the base of the penis visible externally. The latter runs forwards quite an appreciable distance in front of the glandular lobes before terminating in the prepuce (*p.*), which is free and pendulous, almost as in *Cynogale.* The prepuce itself is naked, but the skin of the penis posteriorly is covered with hair. The naked anal area (*a.*) is quite normal.

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* Observed in an adult example of this genus (P. Z. S. 1915, p. 399, fig. 5, F). But in a young example with milk-dentition, since examined, this flap of the bursa arose behind the edge of the pinna.

The gland above described is simple in type, and resembles that of *Genetta* and the Viverrinæ generally in being covered with hair, in having the labia juxtaposed, and in being altogether posterior to the prepuce. It differs from that of *Genetta* and other Viverrines in that the labia do not extend so far forwards towards the prepuce.

The *feet* are small, rounded, and compact, the short toes being tied together by comparatively narrow webs, which extend up to the proximal ends of the digital pads and prevent the digits from being widely separated, the third and fourth toes of both front and hind foot being more closely united than either is to the adjacent digits. There is no trace of skin-lobes protecting the claws, and the area between the digital pads 2 to 5 and the plantar pads is covered with hair as in *Genetta* and *Viverra zibetha*; but a naked strip of skin connects the digital pads of the pollex and hallux with the corresponding lobes of the plantar pad, as in *Nandinia.* The pollex and hallux are moderately well developed, and their digital pads are separated from that of the second digit by a space about equalling that which separates the second from the third digit.

In the fore foot (Pl. VIII. fig. 6) the plantar pad is of normal size, and its three main elements are defined by comparatively deep grooves, and there is a large pollical lobe, broad in front and narrow behind, in contact with the internal lateral lobe. Its narrow posterior portion is in contact with the radial or internal carpal pad, which is long and narrow, and is in contact throughout the greater part of its length with the ulnar or external carpal pad, which is a little longer and considerably thicker than the internal; its anterior end is connected with the posterior end of the external lateral lobe of the plantar pad by a narrow pad-like ridge of integument, stretching obliquely forwards and outwards to reach the plantar pad. The carpal and plantar pads in their entirety resemble tolerably closely those of *Genetta*, the carpal pads taken together being narrower than the plantar pads. The chief differences are these:—The carpal pads both individually and collectively are longer than in that genus, the pollical lobe is a little larger and, in conformity with the longer pollex, is separated by a wider space, covered with hair from the digital lobe of the pollex, and, lastly, the space circumscribed by the plantar and carpal pads, instead of being covered with hair as in *Genetta* and all Viverrines, is naked as in all Paradoxurines.

The hind foot (Pl. VIII. fig. 7) agrees in the main with the fore foot. The three main lobes of the plantar pad are similarly well defined, the hallucal lobe is large and somewhat widely separated by a hairless space from the digital pad of the hallux. From its posterior end there extends backwards (or upwards) and inwards an elongated pad, which is, however, as broad distally as the area of the hallucal lobe it abuts against, but it narrows proximally and ceases near the middle of the underside of the metatarsus a considerable distance below the heel. A corresponding partially divided external metatarsal pad, or thickened ridge of integument, runs backwards from the posterior end of the external lateral lobe of the plantar pad, narrowing as it goes, to meet the internal metatarsal pad below its superior apex; and, as in the fore foot, the relatively depressed space between the carpal and plantar pads is naked. Above the apex of the metatarsal pads there is a long area of the metatarsus completely covered with hair. In connection with the digital pads, a small difference between the fore and hind feet may be noted; those of the third and fourth digits in the hind foot are a little closer together than in the fore foot. They are not united at the base; but in their juxtaposition these pads show a condition intermediate between that seen in the Viverrines and in the typical Paradoxurines.

Mivart's figures of the pads of the specimen he examined, probably a fresh example, agree in the main, so far as the features above described are illustrated, with those observed in the specimen in the British Museum, but in the latter the carpal and metatarsal pads are a little narrower, perhaps owing to shrinkage in alcohol.

From the description here given of the feet of *Hemigalus* it is obvious that Mivart's classification of the genus in the same category of Viverridæ as *Paradoxurus* and *Arctogalidia*, a category characterised by having the "tarsus half bald," is quite indefensible, since it is not true in fact, and ignores the very considerable differences in the matter of hairiness between the soles of the hind feet in *Hemigalus*, on the one hand, and in *Paradoxurus* and *Arctogalidia* on the other.

The points to be noticed about the feet are these. The nakedness of the area between the plantar pad and the carpal or metatarsal pads is a Paradoxurine feature. On the other hand, the narrowness of the conjoined carpal pads is a Viverrine feature, as exemplified in *Genetta*. The reduction of the metatarsal pads both in breadth and width, and the relatively large area of the metatarsus which is overgrown with hair, while distinguishing the hind foot from that of the Paradoxurines, is not in accord with the condition observed in the Viverrines. It comes nearest to the type seen in *Genetta*, but in the latter these pads are less well developed close to the plantar pad, but extend much farther up towards the heel.

Until 1892 the genus *Hemigalus* occupied an isolated position, without near allies. Gray made it the sole representative of a special tribe of the Viverridæ, called Hemigalina; but possibly because *Hemigalus* was monotypical, this classification was not adopted by later writers, who merely quoted *Hemigalus* as one of the many genera constituting the heterogeneous subfamily Viverrinæ.

In 1892, however, Mr. Oldfield Thomas described * a second species, *Hemigale hosei*, based upon specimens from Mt. Dulit in N. Borneo. Chiefly on account of certain well-marked differences in the teeth, he subsequently gave this species generic rank under the name *Diplogale*, and at the same time described a third genus *Chrotogale* to receive a species, *Ch. owstoni*, from Yunnan, differing from both *Hemigalus* and *Diplogale* in dentition, although resembling the type of the former in being transversely banded instead of devoid of pattern like *D. hosei* †.

There is unfortunately no spirit-preserved material, either of *Diplogale* or *Chrotogale*, available for examination. But, so far as can be judged from dry skins, these genera resemble *Hemigalus* in the shape of the rhinarium, the development of the pads, and the extent to which the lower sides of the feet are overgrown with hair. Nothing unfortunately can be made out with regard to the scent-gland, but the affinities between the three genera indicated by the many points of resemblance and the fewness and nature of the differences between them justify, from the analogy supplied by the Viverrines and Paradoxurines, the conclusion that *Diplogale* and *Chrotogale* possess scent-glands similar to, though perhaps not absolutely structurally identical with, those of *Hemigalus*. If this be so, the three genera in question form a compact little group of the Viverridæ, distinguishable on the one hand from the Viverrinæ, and on the other from the Paradoxurinæ, exemplified particularly by *Paradoxurus* and *Paguma*, and in some respects, especially as regards the feet, intermediate between them. I think, therefore, that Gray was right in isolating *Hemigalus*, and I propose to adopt for the group it typifies the name he proposed under its modernised form, Hemigalinæ, and to regard this group as of subfamily rank.

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* Ann. & Mag. Nat. Hist. (6) ix. p. 250; also P. Z. S. 1892, p. 222, pls xviii. & xix.

† P. Z. S. 1912, pp 499 503

Possibly from want of properly preserved material, I am not able to point out any external characters to distinguish these three genera, apart from those mentioned by Thomas: namely, the absence of pattern in *Diplogale* and the normal direction of the hair on the neck in *Chrotogale*—characters which in themselves are hardly of generic value. Reliance must therefore be placed upon the cranial and dental characters mentioned by Thomas.

By these the three may be separated as follows:—

a. Premaxillæ (in immature form, at least) produced far beyond canines, separated by a long median palatal fissure, the incisors broad and forming a strongly curved line; direction of hair on the neck normal; (pattern as in *Hemigalus*) .... *Chrotogale*.

b. Premaxillæ normally produced, in contact on the palate throughout their length; the incisors narrow and forming a gently curved line; hair on the neck reversed in direction.

  a'. First upper premolar small, one-rooted, palate considerably wider behind than in front; pattern composed of broad transverse stripes on a light ground . *Hemigalus*

  b'. First upper premolar large and two-rooted; palate nearly as wide in front as behind; no pattern, colour "otter-like" .... *Diplogale*.

In attempting to affiliate these genera, there are one or two points to consider. First, the very specialised pattern of *Hemigalus* and *Chrotogale*, and, second, the specialised dentition of *Chrotogale*. Taking these two features in conjunction, I think the assumption that *Chrotogale* is a specialised derivative of *Hemigalus* is justified. The position of *Diplogale* is more doubtful. The absence of pattern precludes the possibility of drawing any inference from that source. Possibly the newly-born young might supply the clue as to whether this genus is descended from a form with the pattern of *Hemigalus* or from one with a more generalised pattern such as is seen in *Linsang* or *Genetta*, from which, as explained above, the pattern of *Hemigalus* was probably derived.

If the pattern is shown in the young and proves to be of the *Hemigalus* type, the fact will attest that, in this respect at all events, *Diplogale* is a modification of that type. On the other hand, if the pattern should be like that of *Genetta* or *Linsang*, the inference will be that *Diplogale* is descended from an ancestor common to it and *Hemigalus*. But, with our present knowledge, the only information we have to go upon is that supplied by the dentition; and since a large double-rooted upper first premolar probably preceded in evolution a small one-rooted homologous tooth, *Diplogale* must, I think, be regarded provisionally as a more primitive type than *Hemigalus* *.

Note upon the Name Hemigalus derbyanus.

The species described in this paper is commonly quoted as *Hemigale hardwickii*. There are reasons, however, for regarding this specific title as inadmissible.

In 1827, Lesson (Man. Mamm. p. 172) described under the name *Viverra hardwichii* a species which, in Trouessart's Catalogue, is regarded as the same as *Linsang linsang* (=*gracilis*). However that may be, the name certainly belongs to a species quite distinct from the one that currently passes as *H. hardwickii*, Gray, which was also assigned originally to *Viverra*; and since the two forms were obviously dedicated to the same man, General Hardwicke, the name employed by Gray (Spic. Zool. p. 9, 1830) is not available for the species to which Gray applied it, according to the old-fashioned and commonsense system of nomenclature. Nevertheless, those who maintain that a difference between two names of one letter, of whatever kind, where no misprint is involved, renders both valid, must consistently admit *hardwichii*, Lesson, and *hardwickii*, Gray, provided the species are, as appears, distinct. That Lesson's spelling of the name was not certainly a misprint, *i. e.* an overlooked error by the type-setter, is shown by the full title he used, namely, "Le Civette de Hardwich, *Viverra hardwichii.*" Lesson made a mistake in Hardwicke's name—that is all. This raises a nice point for disputation, which it would be profitless to pursue further.

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* For descriptions of the muzzle, ears, feet, and glands of the Viverrinæ and Paradoxurinæ, see P. Z. S. 1915, pp. 131-140 & pp. 387-412; and of the Cynogalinæ, Ann. & Mag. Nat. Hist. (8) xv. pp. 351-360 (1915).

There remains for settlement, however, the question as to the identity of *Viverra hardwickii*, Gray. By common consent, the species has been regarded as the same as the subject of the present paper, namely, the animal subsequently described by Gray himself as *Paradoxurus derbyanus* (Charlesworth's Nat. Hist. i. p. 579, 1837), by Jourdan as *Hémigale zèbre*, and by Müller as *Viverra boiei*.

But the type of *V. hardwickii*, Gray, was a figure of a Malayan animal by Major Farquhar. This figure, said to be in the collection of the Asiatic Society, I have not seen. Gray, however, described the tail as having six or seven blackish rings, the last occupying the terminal fourth of the organ; the neck as being marked with three small stripes; and the back with six broader, somewhat lunate bands. Since this description, especially as regards the annulation of the tail, does not agree with the species that currently passes as *Hemigalus hardwickii*, that name is not admissible for it. I therefore adopt *derbyanus*, setting aside the probability of several subspecies being concerned. It is odd that a refined, if injudicious, "splitter" like Gray ignored in his later works the differences here pointed out. In 1869, for example, he made his *Paradoxurus derbyanus* (Cat. Carn. etc. p. 57) synonymous with his *Viverra hardwickii*; but the description of the species there printed does not agree with the one he previously gave of *V. hardwickii*. The type of *Paradoxurus derbyanus* is in the British Museum, so there is no doubt as to the identity of that form *.

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* This note was written before I had seen Mr. O. Thomas's remarks upon this species (Journ. Bombay Nat. Hist. Soc. xxiii. no. 4, pp. 612 613, 1915). Mr. Thomas adopts the name *Hemigalus derbianus*, admitting Gray's emendation of the spelling of the specific title. Although the result in this particular instance is of little moment, it should be remembered that the allowance of such an alteration is a precedent dangerous to nominal stability in general. Mr. Thomas, moreover, rejects *hardwickii*, Gray, on the grounds that *hardwichii*, Lesson, was a misprint. But my independent arrival at the conclusion that *hardwichii* cannot on the evidence be dismissed as an obvious misprint, shows that the point is one about which different opinions may be held; and since Mr. Thomas does not discuss my second reason for rejecting *hardwickii* — namely, the uncertainty as to the identity of the species so named by Gray in 1830—I have allowed my notes on the names to stand as originally written, although the conclusion is practically the same as Mr. Thomas's.

EXPLANATION OF PLATE VIII.

Fig. 1. Lateral view of the rhinarium of *Hemigalus derbyanus.*

Fig. 2. Anterior view of the same.

Fig. 3. Superior view of the same.

Fig. 4. Base of the left ear. *s.*, supratragus or plica principalis; *b.*, bursa, the margin of the posterior flap dotted in behind the edge of the pinna; *pi.* and *pe.*, internal and external posterior ridges; *c.*, crest on outer side of *pe.*; *o.*, inferior orifice of meatus; *ae.* and *ai.*, external and internal anterior ridges, the former bearing the tragus below, the latter the semicircular flap above.

Fig. 5. Anal and genital area of male. *a.*, anus; *sc.*, scrotum; *gl.*, gland; *p.*, prepuce.

Fig. 6. Left fore foot from below.

Fig. 7. Left hind foot from below.

XXII.—*Some Observations on the Isopod* Idotea hectica (*Pallas*). By Walter E. Collinge, M.Sc., F.L.S., F.E.S., Research Fellow of the University of St. Andrews, the Gatty Marine Laboratory, St. Andrews.

[Plate IX.]

In connection with an investigation which I am at present carrying out on the British species of Isopoda of the Family Idoteidæ, Professor M'Intosh has very kindly placed at my disposal a number of specimens, amongst which is one from the Atlantic Ocean which I believe to be referable to the *Oniscus hecticus* of Pallas.

This species was described by Pallas in 1771 * from specimens obtained from the Atlantic, though most of the subsequent records are from the Mediterranean region. Miers † mentions having examined specimens from S. Europe (*P. B. Webb*) and Tripoli (*T. Ritchie*) in the British Museum collection, and from the Muséum d'Histoire naturelle of Paris specimens from the Mediterranean (*Roux*), Nice (*Risso*), Algeria (*Lucas*), and Bourbon (*Breon*).

The *I. viridissima* of Risso is regarded as synonymous with this species by Miers, who also places the *Stenosoma eruginosa* of Costa in the same category, but with a query.

So far as I am aware, *I. hectica* has been only imperfectly described and still more imperfectly figured; the purpose of the present communication is to supplement these.

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* Spicil. Zool. 1772, i. (fasc. 9) p. 61, pl. iv. fig. 10.

† Journ. Linn. Soc., Zool. 1883, vol. xvi.

Idotea hectica (Pallas).

Body (fig. 1) elongate, narrow-oblong, slightly narrowed towards the head, convex; longitudinal median dorsal keel extending from the first mesosomatic segment to the end of the anterior third of the terminal segment, epimera not visible dorsally. Cephalon convex, anterior margin with a deep, almost semicircular excavation; lateral lobes broad and obtuse; epistome shallow and produced into a short conical rostrum. Eyes small, situated dorso-laterally. Antennulæ (fig. 2) 4-jointed, the first one being stout and broad. Antennæ (fig. 3) slightly over half the length of the cephalon and mesosome, peduncle with the last two joints elongated and subequal; flagellum multiarticulate. First maxillæ (fig. 4) with outer lobe terminating in seven curved spines, the inner lobe with three dense setaceous ones. Second maxillæ (fig. 5) short, thin, and plate-like, terminating in three setaceous lobes. The segments of the mesosome are about equal in length, excepting the first, which is somewhat shorter than any of the others, all produced backwardly in the median line to a point which is especially prominent on the sixth and seventh segments; postero-lateral angles not acute. Maxillipedes (fig. 6) thin and flattened, with 4-jointed palp, inner basal segment unjointed. Thoracic appendages slender and all similar in character. The abdomen is composed of three distinct segments, with suture-lines on either side of another partly coalesced segment, the third or terminal segment measuring 14 mm. in length and 4 mm. in width at the base, distally with a semicircular emargination, and the postero-lateral angles produced and acute. Uropoda (fig. 7) almost straight on the inner side with prominent raised inner margin, broader posteriorly than anteriorly, terminally the basal plate is oblique; exopodite a small setose spine; endopodite straight on the inner side, slightly curved externally, with posterior margin slightly emarginate.

Length 45·5 mm. Colour (in alcohol) fawn with minute decolorized pigment-spots.

Hab. Atlantic Ocean, 1864 (*Mr. Sibbald*).

According to Miers, Lucas states that the colour is a fine green, laterally margined and minutely punctulated with reddish. In the diagnosis given by Miers (*op. cit.* p. 46), it is stated that the longitudinal median dorsal keel "is obsolete on the terminal postabdominal segment," but this is not so in the specimen I have examined. He also states that the length of the antennæ is "as long, or nearly as long, as the body, without the postabdomen." In the example I have, the antennæ are unfortunately imperfect, there being only twelve joints on the left flagellum and ten on the right one, Miers gives the numbers as 14 to 24, but, even with the addition of the missing joints, I think he has overstated the length.

The antennules are short and slender, extending slightly beyond the antepenultimate peduncular joint of the antennæ. The second joint of the antennæ is deeply grooved laterally, and the fourth and fifth joints elongated and subequal.

The mouth-parts have not hitherto been described or figured. The maxillæ present no special features. The maxillipedes are thin and flattened, in consequence of which the fourth joint does not move in a groove on the anterior border of the third joint, a character I have found in various stages of development in quite a large number of species of this genus, but, curiously, not mentioned in any of the descriptions, so far as I am aware.

I. hectica belongs to that division of the genus *Idotea* which is characterized by the narrow, elongated, filiform body, and in which the epimera are either not visible dorsally or else are very small, and contains such species as *I. linearis* (Linn.), *I. indica*, M.-Edwards, and *I. elongata*, Miers.

EXPLANATION OF PLATE IX.

Fig. 1. Dorsal view.
Fig. 2. Antennule.
Fig. 3. Peduncle of antennæ.
Fig. 4. First maxilla.
Fig. 5. Second maxilla, terminal portion.
Fig. 6. Maxillipede.
Fig. 7. Left uropod.

XXIII.—*Descriptions of new Species of Mollusca from various Localities.* By G. B. SOWERBY, F.L.S.

[Plate X.]

Drillia parciplicata, sp. n. (Pl. X. fig. 1.)

Testa elongato-acuminata, sordide albida; spira elongata; anfractus 7, primus rotundatus, secundus planato vix convexus, sequentes convexi, obtusissime angulati, oblique parci-plicati, ad suturam leviter concavi; anfractus ultimus oblongus, convexus, fere lævis ½ longitudinis testæ æquans. Apertura oblonga, latiuscula; labrum acutum, leviter inflexum, postice late et profunde

sinuatum; columella rectiuscula, tenuiter callosa; canalis brevis, latus.

Long. 13, maj. diam. 5 mm.

Hab. Nagasaki.

This species is chiefly characterized by a few smooth oblique plicæ on the whorls of the spire.

Columbella plicatospira, sp. n. (Pl. X. fig. 2.)

Testa subcylindracea, polita, pallide lutescens, juxta suturam fascia interrupta rufo-fusca ornata; spira elata, convexiuscula; anfractus 6, leviter convexi, haud angulati, plicis numerosis læves crassiusculi, interstitiis paulo angustioribus, longitudinaliter instructi, sutura angustissima sejuncti; anfractus ultimus oblongus, supra leviter convexus, infra medium contractus, infra suturam breviter sed conspicue plicatus, aliter lævis. Apertura elongata, mediocriter lata; labrum incrassatum, intus quinquedentatum; columella rectiuscula tenuissime lamellata.

Long. 10, maj. diam. 3½ mm.

Hab. Japan.

This shell is chiefly characterized by the stout straight plicæ on the whorls of the spire and the few short ones, rendered conspicuous by the bright brown interrupted band, and forming a sort of crown to the body-whorl.

Olivella inusta, sp. n. (Pl. X. fig. 6.)

Testa parva, rimata, oblonga, solidula, nitida, pallido fusco-luteola, saturate fusco late balteata; spira acuta; anfractus 5, levissime convexi, sutura angustissimo canaliculata sejuncti; anfractus ultimus subcylindricus ⅗ longitudinis testæ vix æquans, infra lira angusta obliqua instructus, supra et infra nitide fusco late balteatus. Apertura angusto trigona; labrum vix incrassatum; columella albo callosa, sinistrorsum obliqua.

Long. 3½, maj. diam. 2 mm.

Hab. Florida.

Chiefly recognized by the two broad shining bands and the cylindrical form of the body-whorl.

Lotorium (*Cymatium*) *kiiensis*, sp. n. (Pl. X. fig. 7.)

Testa subfusiformis, antice rostrata, postice pyramidalis, irregulariter varicosa et longitudinaliter plicata, liris angustis transversis paulo elevatis, creberrime granulosis sculpta, epidermide tenuis partim scabrosa induta; spira elata, conoidalis; anfractus 6, primi rotundati, reliquiæ obtuse angulati: anfractus ultimus elongato-pyriformis, lateribus crassivaricosis, plicis paucis distantibus

munitus; rostrum elongatum, irregulariter tortuosum. Apertura ovalis, intus rufo-violacea, leviter sulcata; labrum incrassatum, intus sex-nodulosum; columella leviter arcuata, tenuiter albo callosa, transversim anguste granoso lirata, infra medium biplicatum.
Long. 37, lat. 18 mm.

Hab. Kii, Japan.

Compared with Reeve's *Triton exaratus*, this shell is of a much narrower and less angular form. It somewhat approaches *T. elongatus*, also of Reeve.

Natica (*Polinices*) *tenuicula*, sp. n. (Pl. X. fig. 3.)

Testa subglobosa, tenuis, umbilicata, pallide luteo-fuscescens, postice nigro-fusca; spira breviter conica; anfractus 4½, convexi, læves, sutura angustissime canaliculata sejuncti; anfractus ultimus amplus, inflatus, rotundatus, oblique irregulariter rugosus. Apertura ampla, intus fusca, antice albo radiata; labrum tenue, arcuatum; columella rectiuscula, postice tenuiter callosa; umbilicus profundus, mediocriter latus.
Long. 37, maj. diam. 34; apert. long. 30, lat. 18 mm.

Hab. Nomuro, Japan.

This shell is hardly comparable with any known species. It is of a light substance and has somewhat the external appearance of a species of *Amaura*. The operculum is unfortunately wanting.

Pentadactylus fusco-imbricatus, sp. n. (Pl. X. fig. 4.)

Testa fusiformis, anguste rimata, pallide luteola, fusco maculata, profuse squamulata, longitudinaliter costata, squamis aculeatis fuscis supra costas instructa; spira elata, acuta; anfractus 7, obtuse angulati; sutura vix conspicua; anfractus ultimus supra convexus, infra medium constrictus. Apertura elongata, leviter sinuata, antice angusta, postice latior; labrum leviter incrassatum, fimbriatum, extus aculeatum, intus quinque denticulatum; canalis mediocriter latus; columella lævis, supra arcuata, infra leviter sinuata.
Long. 19, diam. 12 mm.

Hab. Hawaii.

Only four specimens of this species were sent to us some years ago from Hawaii. The one I have selected as the type is the most perfect, and the conspicuous brown scales are sharper and more prominent than in the others. The species seems to vary considerably, and I delayed describing it in the hope of getting more specimens, which, however, have not come. The brown scales on the light yellowish ground form a very conspicuous character.

Littorina eudeli, sp. n. (Pl. X. fig. 5.)

Testa ovato-turbinata, solidiuscula, contecte rimata, pallida, lineis longitudinaliter undulatis picta; spira elata, acuta; anfractus 5, convexe rotundati, sutura angustissima sejuncti; anfractus ultimus amplus, rotunde convexus, supra et infra spiraliter inepte sulcatus. Apertura late semicircularis, leviter obliqua, fauce glabra, fusca; labrum arcuatum, acutum; columella obliqua, planulato-callosa, fusco tincta.
Long. 11, diam. 9 mm.

Hab. Pondicherry (*Eudel*).

At the sale in Paris of the collection of Captain Emile Eudel in 1893, I purchased a considerable number of shells of this species, which all these years appears to have remained unnamed. I am now venturing to give it a name, as it seems quite different from any known species. The ziczac markings seem at once to suggest the name *L. ziczac*, but the West-Indian species of that name is more elately conical and has a distinct angle at the periphery.

Diala vitrea, sp. n. (Pl. X. fig. 8.)

Testa ovato-pyramidalis, vix rimata, pellucida, tenuissima, glabra vel longitudinaliter obscurissime scalpta; spira elate conica, acuta; anfractus 6, convexi, leviter rotundati; ultimus longitudinis spiram fere æquans, leviter inflata; varicibus paucis, vix conspicuis, haud elevatis. Apertura ovalis; labrum tenue, simpex; columella leviter opaca, arcuata.
Long. 6, diam. 5 mm.

Hab. Ise, Japan (*Hirase*).

A delicate transparent shell, with much the appearance of a small *Limnæa*. The varices, characteristic of the genus, are not at all prominent, and appear in the form of two or three slightly opaque rays on the body-whorl and one on the penultimate.

Minolia liricincta, sp. n. (Pl. X. fig. 15.)

Testa minuta, globulosa, crassiuscula, umbilicata, alba, postice pallide fusco tincta; spira breviter conica, subgradata: anfractus 3½, convexi, penultimus obtuse angulatus, spiraliter triliratus; anfractus ultimus globosus, spiraliter sex-liratus, supra obtuse angulatus, ad peripheriam rotundatus; umbilicus profundus,

circularis, mediocriter latus. Apertura circularis; peristoma simplex.
Alt. 2½, lat. 2¼ mm.

Hab. Bitter Lakes, near Suez.

A little white shell of a globular form, acute at the apex, the first whorls being tinged with light brown. In the absence of the operculum I cannot be quite sure of the generic position of this species, but think I have placed it correctly.

Pecten (Chlamys) scabricostatus, sp. n. (Pl. X. fig. 14.)

Testa æquivalvis, æquilateralis, tenuicula, suborbicularis compressiuscula, supra peracuta, infra rotundata; auriculis valde inæqualibus, sinistra lata, acutangulata leviter squamosa, dextra multo brevior, rectangularis, valva sinistra leviter convexa, undique angustissime radiatim lirata, costis 18–20 rotundatis, crassiusculis, aliquis breviter erecte squamatis radiata.
Alt. 55, lat. 50, crass. 16 mm.

Hab. Swan River, West Australia.

About fifty years ago a considerable number of shells of this species came to London, and were distributed under various names, such as *senatorius* (Gmel.), *gloriosus* (Reeve), *prunum* (Reeve), &c.; but I have always considered the identification, to say the least of it, quite unsatisfactory. The species differs from all the varieties of *senatorius* (including those bearing the two last-mentioned names) by its broader and less numerous ribs, some of them bearing a few erect prominent scales, a character which at once catches the eye, as they only appear generally on every fourth rib, the others being nearly smooth or having only very small inconspicuous foliation.

The colours, as in *P. senatorius*, are very varied; the shell I have selected as type is light brown at the upper part, and the remainder pink, while some are plain yellow all over; others again are mottled with brown, yellow, and white.

The dimensions given are about the average. The largest of the ten specimens before me measures 68 × 65 and the smaller 10 × 36 mm.; but I have seen one magnificent specimen of a beautiful clear yellow colour throughout and measuring 78 mm. This shell belonged to the collection of the late S. I. Da Costa.

Volsella compta, sp. n. (Pl. X. fig. 10.)

Testa oblonga, tenuis, vivide purpurea, epidermide tenuis leviter

scabrosa induta, concentrice creberrime scalpta; margo dorsalis leviter arcuatus, postice rotundatus, ventralis leviter incurvus; umbones obtusi, subterminali.

Hab. Iyo, Japan (*Hirase*).

Cardium (*Serripes*) *notabile*, sp. n. (Pl. X. fig. 9.)

Testa inflata, sordide albida, epidermide pallida tenuiter induta, concentrice creberrime striata, utrinque breviter radiatim sulcata; margo dorsalis posticus late arcuatus, anticus brevis, valde declivis, ventralis subobliquo arcuatus; latus anticum rotundatum, posticum late arcuatum; umbones obtusi, valde incurvati, ante medium locati.

Antero-post. 80, umbono-marg. 77 mm.

Hab. Wakasa, Japan (*Hirase*).

I have as yet only seen one specimen of this species, which is of a much more tumid form than *Serripes grönlandicus.*

Macoma transcalpta, sp. n. (Pl. X. fig. 11.)

Testa oblongo-subovalis, tenuicula, leviter compressa, albida, creberrime oblique striata, postice acute angulata, concentrice filo-striata; margo dorsalis anticus elongatus, levissime arcuatus, posticus brevis valde declivis; margo ventralis arcuatus; latus anticum rotundatum, posticum obtuse angulatum; umbones minuti, post medium locati; dens cardinalis in utraque valvæ duo, lateralis nullis.

Antero-post. 25, umbono-marg. 15 mm.

Hab. Oshima, Japan.

Distinguished by the very fine oblique striæ nearly covering the surface of both valves.

Macoma anatinoides, sp. n. (Pl. X. fig. 12.)

Testa oblonga, tenuicula, albida, iridescens, lævis, concentrice subtilissime striata, postice leviter hiata; margo dorsalis anticus elongatus, arcuatus; posticus leviter declivis, rectiuscula; ventralis longus, antice rotundatus, postice leviter ascendens; umbones vix elevati, post medium locati; dens cardinalis in utraque valvæ duo, lateralis nullis.

Antero-post. 28, umbono-marg. 15 mm.

Hab. Philippines (?).

The shell is of simple character, resembling in form a species of *Anatina.* The surface is apparently smooth, but under the lens it is seen to be closely concentrically striated, and it has an iridescent lustre.

Several specimens were found among a lot of Philippine shells; but the habitat, although probable, must be regarded as uncertain.

Donax cacuminatus, sp. n. (Pl. X. fig. 13.)

Testa trigonalis, crassa, alba, postice fusco-tincta, undique radiatim crebrisulcata, postice recto declivis, acutangulata, antice leviter producta; umbones acuti, post medium locati.
Antero-post. 22, umbono-marg. 15 mm.

Hab. I. Pins, New Caledonia.

Somewhat resembling the West-Indian *D. denticulatus*, but more acute at the posterior angle, and without the undulated corrugation of the posterior area characteristic of that species.

EXPLANATION OF PLATE X.

Fig. 1. *Drillia parciplicata.*
Fig. 2. *Columbella plicatospira.*
Fig. 3. *Natica* (*Polinices*) *tenuicula.*
Fig. 4. *Pentadactylus fusco-imbricatus.*
Fig. 5. *Littorina eudeli.*
Fig. 6. *Olivella inusta.*
Fig. 7. *Lotorium* (*Cymatium*) *kiiensis.*
Fig. 8. *Diala vitrea.*
Fig. 9. *Cardium* (*Serripes*) *notabile.*
Fig. 10. *Volsella compta.*
Fig. 11. *Macoma transculpta.*
Fig. 12. —— *anatinoides.*
Fig. 13. *Donax cacuminatus*
Fig. 14. *Pecten* (*Chlamys*) *scabricostatus.*
Fig. 15. *Minolia liricincta.*

XXIV.—*New Species of Indo-Malayan Lepidoptera.*

By Colonel C. SWINHOE, M.A., F.L.S.

DANAINÆ.

Bahora annetta, nov.

♂. Pale ochraceous, larger than *B. aspasia*, Fabr., from Java and the Malay Peninsula, very nearly resembles Doherty's figure of his *chrysea* from Engano Island; but the cell of the fore wing is densely clouded with black, and the ochreous interspace above the hinder margin is quite clear, and broader and more squarely cut at its outer end than in any other of the allied forms: on the hind wing also the ochreous interspaces are clearer and broader and the two at the abdominal margin more extended.

♀. Both wings with the interspaces very slightly tinted with ochreous, otherwise much resembling the female of *aspasia*.

Expanse of wings, ♂ ♀, $3\frac{2}{10}$ inches.

Hab. Fergusson Island.

Near *B. rita*, Fruhstorfer, from Bawean Island.

Tirumala mistella, nov.

♂. Nearest to *T. microsticta*, Butler, from Borneo; the colour and markings are very similar, but it is a smaller insect and all the spots are larger, the discal and submarginal series on the hind wing are quite complete, and all the white stripes are broader. On the underside all the stripes of both wings are much broader and the spots much larger and more prominent.

Expanse of wings $3\frac{4}{10}$ inches.

Hab. Malang, Java.

Parantica terilus.

Danais terilus, Fruhstorfer, Seitz, Gross. Schmett. ix. p. 208 (1910).

Hab. Sandakan, N. Borneo, Burma.

I have two males from Thyetmio and Tenasserim which are identical with the Sandakan examples; it is very near to *D. borneensis*, Staudinger, which comes from Sarawak; the whitish lines are somewhat thinner, and, indeed, the differences between these and *erycina*, Fruhs., from Nias, and *mœneus*, Fruhs., from Sumatra, are barely distinguishable.

ELYMNIINÆ.

Elymnias merula, nov.

♂. Upperside deep black, as dark as *E. hecate*, Butler, from North Borneo: fore wing with the costa spotted with blue, three blue streaks near the apex and three submarginal blue spots in interspaces 2, 3, and 4: hind wing with a slight shade of fulvous on the outer margin; outer margin of both wings as in *hecate*. Underside dark chestnut-brown, densely striated with pale blue: fore wing with white costal points, which become thickly clustered together at the apex: hind wing with a small prominent bluish-white spot below the middle of the costa.

Expanse of wings 2$\frac{8}{10}$ inches.

Hab. Kandy, Ceylon.

Except for the white spot on the hind wings beneath, it much resembles *hecate*.

SATYRINÆ.

Melanitis liukiuana, nov.

♂. Upperside as dark as in *obsolescens*, Felder, from the Celebes: the outer margin of the fore wing somewhat produced, the margin a little excavated beneath it, as is usual in all females of the dry-season form of this group; in this species the outline of both sexes is similar, and the wings are more square in shape than is usual; the subapical ocellus of the fore wing is small, dull black, with a white pupil in its centre and a slight indication of orange on its inner side: on the hind wing there is the usual black ocellus near the anal angle, with a white pupil, and faintly ringed with dull orange, and there is another similar but very small ocellus in the second interspace, nearer the outer margin. Underside much darker than in *obsolescens*, the striations much darker brown; the ocelli similarly placed, but on the hind wing larger and brighter-coloured, the ocelli being placed as on the upperside, but very small on the fore wing, and having three additional ocelli, two close to the apex and one in interspace 2, all three much nearer the margin than the one in interspace 3; on the hind wing there are three additional ocelli—a large one near the apex, two small ones in interspaces 4 and 5, and a small double ocellus close to the anal angle.

♀. Only differs from the other sex in having a white spot on a dark ground above the subapical ocellus and in having all the ocelli on the underside much larger.

Expanse of wings, ♂ 3½, ♀ 3 inches.

Hab. Liukiu Islands.

Aphantopus yunnananus, nov.

♂. Upperside as in *A. hyperanthus*, Linn., from Europe: fore wing with a somewhat oval subapical ocellus ringed with dull ochreous, with two white pupils: hind wings with subanal spots as in the type-species. Underside with a subapical spot with two pupils as on the upperside; hind wing with a single, large, subapical ocellus; two smaller ones joined together in interspaces 2 and 3, and a small one near the anal angle.

Expanse of wings 1$\frac{8}{10}$ inch.

Hab. Yunnan, S.W. China.

NYMPHALINÆ.

Adolias larika, nov.

♂. Belongs to the *dirtea* group. Upperside resembling *A. jadeitina*, Fruhstorfer, from Burma; all the spots small and ochreous except one near the apex, which is white; the blue marginal band somewhat broader and nearly reaching the apex; the submarginal spots of the hind wing larger. Underside darker-coloured than in *jadeitina*, the black suffusion near the hinder angle of the fore wing extending inwards into the cell, where the spots are yellow, not white; the first and second duplicate spots in the cell joined together, with two nearly square pale spots ringed with black in it; the markings on both wings disposed as in *jadeitina*.

♀. Above and beneath coloured and marked as in *jadeitina*, but all the spots smaller.

Expanse of wings, ♂ $3\frac{8}{10}$, ♀ 4 inches.

Hab. Lombok Island.

Near *A. sandakana*, Fruhstorfer, from Borneo.

Hypolimnas heteroma, nov.

♂. Upperside much as in *H. alimena*, Linn., from Amboina, the blue band on the hind wing narrower; on the underside the costal and subapical white spots are all very small and the discal band on both wings only very faintly indicated, and there are two white streaks along the abdominal margin.

Expanse of wings $2\frac{8}{10}$ inches.

Hab. Sarawak, N. Borneo.

There is a closely allied species in the B. M. from Amboina.

Hypolimnas curiosa, nov.

♂. Upperside black, as in *H. bolina*, Linn.: fore wing with three small and indistinct blue spots at the end of the cell, two short white streaks near the apex, and a curved row of six minute white postdiscal dots: hind wing with five similar postdiscal dots; cilia of both wings chequered black and white. Underside dull, pale blackish brown; the postdiscal dots on both wings as on the upperside; the marks at the end of the cell of the fore wing represented by a faint whitish band running from the costa across the end of the cell; indications of some whitish submarginal marks, which are continued on the hind wing in a faint whitish macular band; both wings with whitish marginal lunules, which become obsolete before reaching the apex of the fore wing.

Expanse of wings $3\frac{2}{10}$ inches.

Hab. Staru, Central Provinces, India.

May be a sport of *H. bolina*, but is a very peculiar-looking insect and deserves a name.

Hypolimnas alada, nov.

♀. Shape of *H. anomala*, Wallace, from the Malay Archipelago. Upperside black, without any markings except a series of postdiscal white dots on both wings—one in each interspace, and another series of smaller submarginal white dots, two in each interspace, only indistinctly indicated on the fore wing before reaching the apex. Underside very slightly paler than the upperside, the postdiscal and submarginal dots similarly disposed, but on the hind wing the latter are larger: fore wing with three white subcostal dots above the cell, two indistinct, whitish, longitudinal streaks beyond its end: hind wing with a white spot near the middle of the costa, and some more or less indistinct whitish streaks above the anal angle, in two examples almost obsolete.

Expanse of wings $3\frac{2}{10}$ inches.

Hab. Hongkong.

It probably belongs to the *bolina* group. I have three females, all absolutely identical. It is not mentioned in Seitz, and there is nothing like it in the B. M.

Lycænidæ.

Everes bandana, nov.

♂. Upperside blue, much as in *E. parrhasius*, Fabr.; costal line very finely black, outer marginal line of both wings also black: hind wing with two anal black spots ringed with orange-yellow, and in some examples two or three minute similar spots on the margin in continuation; cilia of both wings white, tails black, tipped with white. Underside clear greyish white; fore wing with a grey lunule at the end of the cell; a discal, nearly straight band of grey lunules, one in each interspace; a duplicate, similar, submarginal band and grey marginal line: hind wing with a black subcostal spot one-fourth from the base, another below it, and a subcostal similar spot one-third from the apex; a grey lunule at the end of the cell, a curved discal series of grey lunules ending in a black spot close to the abdominal margin, grey submarginal double row of lunules as on the fore wing, half of them obliterated by a large scarlet patch from vein 5 to a little lower than vein 2, with two prominent black marginal spots in it.

♀. With the upperside ground-colour paler than in the male; fore wing with the apex and costa broadly suffused with black; hind wing with a blackish suffused apical patch, the markings above and below as in the male, the anal spots somewhat more pronounced.

Expanse of wings $\frac{8}{10}$–$\frac{9}{10}$ inch.

Hab. Banda Island; twenty-two males, sixteen females.

Jamides aruensis, nov.

♂. Upperside pale blue, as in *J. elpis*, Godt., but paler; costa of fore wing and outer margin of both wings with a fine black line; wings thinly clothed, some of the markings of the underside, especially on the hind wing, visible; tails black, tipped with white. Underside of a uniform purplish-grey colour, markings white and thin: fore wing with two lines across the end of the cell, two dislocated lines beyond them from the costa to vein 3, two lines below (not dislocated) from vein 3 to vein 1, commencing between the first two and the second pair of lines; a duplex series of submarginal lunules and a fine antecilial line divided by the vein-ends: hind wing with a series of six dislocated lines covering the whole surface of the wing; a submarginal series of large, deep black, triangular spots edged with white much as in *J. aratus*, Cramer, the two nearest the anal angle cut across by scarlet lunules; a marginal row of white points.

Expanse of wings 1½ inch.

Hab. Aru Island.

Jamides alocina, nov.

♂. Upperside milky white tinged with pale lavender-blue, the inner surface of the fore wing and the upper half of the hind wing palest: fore wing with a fine grey costal line; a grey marginal narrow band: hind wing with a submarginal series of small and short black lunular marks, edged with white on both sides, and a fine black marginal line. Underside pale pinkish grey, markings white but indistinct: fore wing with two lines across the end of the cell, continued to the hinder margin beyond its middle, two dislocated lines beyond in the fourth, fifth, and sixth interspaces, with a line in the third interspace from between the last two; two rows of submarginal lines and an indistinct marginal line, all three, dislocated by the veins: hind wing with three rows of transverse double lines at equal distances apart, and a marginal series, all dislocated by the veins; a brownish spot touched with red near the anal angle.

♀. Only differs from the male in having the outer half of the costa of fore wing, the apex broadly and the outer margin dull blackish, and the lunules on the outer margin of the hind wing more pronounced.

Expanse of wings 1¼ inch.

Hab. Haipau, Yet Sauk, Shan States.

Rapala nissa nissoides, nov.

♂ ♀. Upperside with the ground-colour as in *nissa*, Kollar, the fore wing in both sexes with a large, bright red, upper discal, square patch. Underside much as in *nissa*, the upper anal ocellus of the hind wing always minute.

Expanse of wings 1½ inch.

Hab. Haipau, Shan States; a long series of both sexes.

Hesperidæ.

Corone shortlandica, nov.

♀. Upperside resembles the ♀ of *C. palmarum*, Moore, the type of which came from Calcutta, the ochreous spot at the end of the cell smaller, with a smaller spot touching its upper side. Underside paler, the chocolate-colour more or less suffused with grey, markings as on the upperside, but the ochreous macular discal band on the hind wing has a square ochreous patch near the anal angle, connecting it with the outer margin, and between this and the anal angle is a large square black patch. Antennæ black, the upper three-fourths of the club cream-colour, with a black tip; palpi black, with grey hairs; legs pale pinkish grey.

Expanse of wings $1\frac{9}{10}$ inch.

Hab. Shortland Island, Solomons.

There is a male from the Solomon Islands in the B. M. unnamed, which is probably the male of this species.

Suastus plana, nov.

♂. Upperside uniform blackish brown, without any markings. Underside paler: fore wing with an indistinct subapical narrow band a little darker than the ground-colour, inwardly edged with grey, running from the costa near the apex to the outer margin about one-third from the hinder angle: hind wing with some darker and some paler longitudinal stripes very faintly indicated, and with some whitish suffusion on the outer margin; otherwise without any markings. Palpi ochreous grey, legs pale brown; antennæ and club black above, white beneath, the shaft with thin black bands.

Expanse of wings $1\frac{2}{10}$ inch.

Hab. Humboldt Bay, New Guinea.

Astictopterus quadripunctatus, nov.

♂. Upperside uniform glossy olive-brown, as in *A. olivascens*, Moore; is, however, larger, and in the fore wing has two subapical clean-cut white dots; cilia pale chocolate-grey. Underside paler in colour, with a chocolate tint: fore wing with the cell-space darkest, three subapical white dots; marginal line in both wings whitish; cilia darker than on the upperside. Head and body above and below and the legs concolorous with the wings.

Expanse of wings $1\frac{8}{10}$ inch.

Hab. Khasia Hills.

DEILEMERINÆ.

Deilemera coæqualis, nov.

♀. Dull black: fore wing with the discal macular band as in *D. subvelata*, Walker, from Celebes; the upper spot near the costa very much smaller, the white streak from the base below the median vein much broader, half filling up the interspace and ending below the inner end of the lowest spot of the discal band: hind wing with very broad black borders, the veins blackish, some grey suffusion at the base and along the abdominal marginal area. Thorax black, a yellow line down its middle and at the sides and across the front; abdomen above dull black, somewhat tinged with green, white beneath, with black side-spots.

Expanse of wings $1\frac{8}{10}$ inch.

Hab. Sumatra.

Zygænidæ.

Cyclosia ni, nov.

♂. Of the usual *Pintea ferrea* type; all the white spots smaller and better separated, the hind wing darker and brighter blue-green, the underside with all the markings more vivid.

♀. Fore wing with the whitish spots and stripes as in *C. venaria*, Fabricius, from Sikkim and Assam, but all much narrower: hind wing much as in *C. nigrescens*, Moore, from the Andamans, the marginal black band somewhat broader and continued to the anal angle.

Expanse of wings, ♂ $1\frac{9}{10}$, ♀ $2\frac{6}{10}$–$2\frac{7}{10}$ inches.

Hab. Tenasserim, Burma; types in B. M. There are two females from Meymyo in my collection.

Lasiocampidæ.

Ticerra castanea.

Ticerra castanea, Swinhoe, Cat. Het. Mus. Oxon. i. p. 269 (1892). ♂.

♀. Upperside very similar to that of *Taragama intensa*, Moore: fore wing with the white, discal, thin band more sinuous, the white spot in the middle of the costa obsolete: hind wing with the costa broadly white, the base suffused with pale brownish red, becoming dark brown at the immediate base; the central white band broad and the marginal brownish-red band narrow and diffuse inwards. Underside very pale, almost whitish, the veins white; the upperside markings showing through the wings.

Expanse of wings 3 inches.

Hab. Philippines.

Type in B. M.

Odonestis urda, nov.

♂. Allied to *O. plagifera*, Walker; smaller, about half the size, much paler in colour, and with an ochreous-red tint, the markings somewhat similar, but the large brown patch in the upper disc of the fore wing less than half the size; no brown suffusion beyond it, the upper outer part of the wing having only a slightly darker shade of colour than the rest of the wing, and the black spot on the hinder margin near the angle is absent; hind wings, underside of both wings, antennæ, head, and body pale ochreous red without any markings.

Expanse of wings $2\frac{8}{10}$ inches.

Hab. Khasia Hills.

Odonestis malayica, nov.

♂. Belongs to the *plagifera* group, but very much smaller; the discal dark patch on the fore wing, narrow and club-shaped, ending on the upper edge of the cell, is rounded, and is completely encircled by a fine ochreous line which runs down it on each side to the hinder margin; the usual black spot in this margin near the angle is absent; hind wing, head, body, antennæ, and the entire underside dark brown, like the ground-colour of the fore wings above, and very uniform in tone.

♀. Much as in the female of *plagifera*, Walker; the discal patch of the fore wing narrower, corresponding hindwards to the patch on the male.

Expanse of wings, ♂ $1\frac{8}{10}$, ♀ $3\frac{2}{10}$ inches.

Hab. Singapore, Selangor.

Types in B. M.

Hadenidæ.

Cirphis sumatrana, nov.

♂. Fore wing greyish white with chestnut-brown scales, a whitish subcostal streak, an antemedial and a postmedial black spot on the costa, the base and cell suffused with chestnut-brown, the veins white, the median vein to the end of the cell rather thickly white ending with a white spot with a black dot on each side of it, the rest of the wing more or less finely streaked with brown; a brown band from the outer margin below the apex to the hinder margin one-third from the angle, the band thickens upwards: hind wing white, the veins grey, a rather prominent brown spot at the end of the cell; both wings with small black marginal spots in the interspaces; cilia of fore wing pale brown and white, of the hind wing pure white. Underside white: fore wing with some pale brown suffusion on the upper disc; a black spot on the end of the cell, another beyond it and a black spot above the latter, on the costa: hind wing with a rather large black spot at the end of the cell, a discal whorl of black dots; both wings with somewhat prominent black marginal dots; head and palpi pale chestnut; thorax, abdomen, and anal crest grey.

Expanse of wings $1\frac{4}{10}$ inch.

Hab. Padang, Sumatra.

Catocalidæ.

Erebus lombokensis, nov.

♀. Belongs to the *macrops* group (*Nyctipao*), smaller than *javanensis*, Hampson, or *nyctaculis*, Snellen, has the large ocellus of the fore wing oval and somewhat concave on its inner side as in Snellen's species from Celebes, but it differs from all the other species in having the dark transverse bands on both wings evenly curved and not sinuous, and in having only two bands, ante- and postmedial. Underside with a single discal macular band as in *nyctaculis*, the spots smaller, but with no indication of any submarginal spots.

Expanse of wings $4\frac{1}{10}$ inches.

Hab. Lombok Island.

This example much resembles a male in the B. M. from the Philippines wrongly representing *nyctaculis*, Snellen, from the Celebes; in my collection there is a good female example of Snellen's species from the Celebes, not at all resembling my Lombok female.

Noctuidæ.

Ericia epitheca, nov.

♂. Fore wing long and narrow; colour of both wings fuscous, as in typical *E. inangulata*, Guenée, irrorated with brown atoms, the orbicular a brown dot, the reniform a brown spot; medial and discal bands across both wings slightly darker than the ground-colour, indistinct and nearly straight; the discal band expanding upwards on the fore wing, its outer edge sinuous. Underside with all but the base and abdominal area of the hind wing suffused with brown; two medial crenulate brown lines across both wings, and indications of a submarginal band; antennæ unusually long and heavily ciliated.

♀. Like the male, but paler. Upperside with the bands nearly obsolete; the discal band with a large brown spot in the first interspace and a brown streak from the costa. Underside very much paler; a brown spot in the middle of the cell of the fore wing, a brownish postdiscal thin band across both wings and two fine lines near its inner side.

Expanse of wings, ♂ $2\frac{3}{10}$, ♀ $2\frac{1}{10}$ inches.

Hab. Fergusson Island.

Sypna ludifica, nov.

♂ ♀. Upperside very dark blackish brown: fore wing minutely irrorated with ochreous; orbicular and reniform small, ochreous, ringed with black; four indistinct transverse bands, slightly darker than the ground-colour, each band with an ochreous lunular line down the margins, a submarginal sinuous black band: hind wing paler, a thin brown discal angular band, the commencement of a duplicate submarginal band at the anal angle; double lunular black lines close to the outer margin of both wings, with pale centre; cilia brown, with ochreous spots at the end of veins 5, 6, and 7 on the hind wing, more pronounced in the females than in the males; abdomen with an ochreous tip in the male. Underside: both wings with the inner half grey, the outer half blackish brown, with a medial outwardly curved black band, broadly edged with white on both sides; a white patch on the hinder angle of both wings, four white dots on the costa of the fore wing near the apex; marginal white dots on both wings and some whitish suffusion on the upper margin of the hind wing.

Expanse of wings, ♂ $2\frac{3}{10}$, ♀ $2\frac{7}{10}$ inches.

Hab. Kina Balu, N. Borneo.

The larger markings somewhat resemble those on *S. tenebrosa*, Butler, from Sikkim; the markings of a great many forms of this genus have a wonderful resemblance to each other. I have examples from Kina Balu and from Nanchuan in China that cannot be distinguished from *S. umbrosa*, Butler, from Assam, and a female example from Kina Balu that is absolutely identical with females of *S. picta*, Butler, from Japan; it seems highly improbable that non-migrating insects, so widely separated, can be of the same species; the inspection of their genitalia is necessary to decide the matter.

Polydesma lawsoni.

Diatenes (?) *lawsoni*, Felder, Reise Nov. Lep. pl. iii. fig. 630 (1872).

Polydesma pullaria, Swinhoe, Ann. & Mag. Nat. Hist. (7) ix. p. 422 (1902).

Hab. Roebourne, W. Australia, Brisbane.

Hypocala toana, nov.

♂. Upperside: fore wing grey sparsely irrorated with brown atoms, most thickly in the middle where the atoms are large; outer margin with black dots: hind wing pale greyish yellow, with large black outer border occupying more than a third of the wing, marginal edge and cilia white. Underside uniform greyish yellow, a blackish lunular mark at the end of each cell, with white centre, larger on the fore wings than on the hind wings; a blackish discal band across the fore wing; a broad marginal, similarly coloured band on the hind wing, with white outer edging and white cilia; head, body, and legs concolorous with the wings. On the upperside it somewhat resembles *H. holcona*, Swinhoe, from the Andamans.

Expanse of wings 1$\frac{6}{10}$ inch.

Hab. Solomons.

Plecoptera fetna, nov.

♂ ♀. Upperside pale fawn-colour, with a slight fulvous tint: fore wing with traces of ante- and postmedial, transverse, sinuous, brown lines; a lunular pale brownish mark at the end of the cell as in *P. quæsita*, Swinhoe, from Assam, and a discal, sinuous, pale brownish band: hind wing pale greyish ochreous, with a submarginal similarly coloured band, evenly curved; marginal pale brown dots on both wings. Underside whitish, the cell-lunule visible on the fore wing; a brown dot at the upper end of the cell on the hind wing and submarginal pale brown bands on both wings, on the fore wing broad at the apex, narrowing hindwards, narrow on the hind wing.

Expanse of wings, ♂ ♀, 1$\frac{4}{10}$ to 1$\frac{5}{10}$ inch.

Hab. Kina Balu.

Plecoptera lobelia, nov.

♂. Much as in the preceding species, the colour of the fore wing much darker; on the underside the upper basal half of the fore wing is shaded with brown; the submarginal bands of both wings are much broader, and on the hind wing there is a crenulate brown line just inside of, and adjacent to, the submarginal brown band.

Expanse of wings 1$\frac{4}{10}$ inch.

Hab. Gilolo Island.

Cultripalpa dodara, nov.

♂. Both wings pale chocolate-brown: fore wing with a white antemedial brown irregular line and a postmedial brown line from the costa, curving round inwards, then inwardly oblique to the middle of the hind margin of the wing, both lines edged on both sides with white much as in *C. partita*, Guenée, from India; a white dot in the cell, and three blackish, almost quadrate patches or large spots in the disc, one inside the curve of the outer line, the other two below it: hind wing with a blackish streak closing the cell, edged on both sides with white; a medial sinuous brown line edged on both sides with white, in continuation of the outer line of the fore wing; a discal, sinuous, blackish, narrow band, more or less macular from the anal angle, becoming obsolete beyond the middle; both wings with black marginal lunules, inwardly edged with white. Underside pale chocolate-grey, irrorated with darker grey: fore wing with a white dot in the cell: hind wing with a black dot at the end of the cell; both wings with a series of black dots across the disc, hardly visible on the fore wing.

Expanse of wings $1\frac{2}{10}$ inch.

Hab. Manilla, Philippines.

Boarmiidæ.

Myrteta similaria, nov.

Very similar to *M. ocernaria*, mihi, A. M. N. H. (6) xii. p. 152 (1893), from the Khasia Hills, but much larger and the hind wing more distinctly angled, has the three oblique ochreous-brown lines and the costa and cilia also ochreous brown, but the middle line from the abdominal margin of the hind wing does not extend to the apex of the fore wing, but is carried inwards before the apex, and the discal line has ochreous-brown spots on it on the fore wing.

Expanse of wing 2 inches.

Hab. Padang, W. Sumatra.

Mimochroa salentia, nov.

♂. Upperside olive-green, very similar in colour to *M. viridescens*, Warren; an indistinct antemedial line as in that form and as in *M. angulifascia*, Moore; discal band dark olive-green, narrow and well-defined, produced outwardly below the costa of fore wing into an acute angle, then gradually narrowing hindwards to a point on the hinder margin, continued across the hind wing, where it is also narrow and well defined and has an outward angle as in *angulifascia* above its middle; the entire surface in both wings from the base to the discal band uniform in colour, being thickly irrorated with grey atoms; the space outside this band similarly coloured and irrorated, but slightly paler, with some darker suffusion in parts; a dark apical patch on fore wing with a whitish smear between it and the upper part of the angle of the discal band. Underside with a medial brown line outwardly edged with white across both wings; from this line to the base the colour is uniform greyish pink, outside this line greyish white broadly suffused with pinkish down its middle.

Expanse of wings $1\frac{6}{10}$ inch.

Hab. Gédé, Java.

Chogada rasanaria, nov.

♂. Near *C. fraterna*, Moore, from Sikkim and Assam, with much less brown suffusion: fore wing with less suffusion at the base inside the antemedial line, the middle area between the two lines more or less clear; the space outside the postmedial line somewhat darker, almost uniform in colour, no black patches; the submarginal crenulate white line nearly obsolete: hind wing with the entire space from the base to the postmedial line quite clear, a white cell-spot, ringed with brown; the postmedial line curving more inwards, terminating nearer the middle of the abdominal margin; the white submarginal band and lines nearly obsolete, the black discal suffusion wanting. Underside similar to that of *fraterna*.

Expanse of wings 1$\frac{7}{10}$ inch.

Hab. Aberdeen, Andamans.

Chogada anestiaria, nov.

♂ ♀. Resembles *C. illustraria*, Walker, from Moreton Bay, Australia, and *determinata*, Walker, from Sarawak, Borneo, especially with its broad black borders on the underside; differs from both in the very large black spot at the end of the cell of the fore wing, with a prominent white cross inside it; the discal sinuous black line is more deeply angled outwards below the costa and more inwardly curved hindwards, and in the hind wing is much more angled outwards; the female is white with little or no suffusion and no bands, the lines similarly disposed. Belongs to the *inflexaria* group, *C. inflexaria*, Snellen, from the Celebes; all the different island forms of this group much resemble each other, and are more or less similar to the Indian forms of *C. alienaria*, Walker, but on careful examination it will be found that nearly every island has its own peculiar form, with distinctive characters peculiar to the island; the females are very difficult to distinguish from each other.

Expanse of wings, ♂ ♀, 1$\frac{8}{10}$ to 2 inches.

Hab. Bt. C. New Guinea, Ekeiki, Mt. Kebea.

There appear to be several forms of *Chogada* in N. Guinea, besides the above, of which I have several examples: I have *xylinopa*, Meyrick, *papuensis*, Warren, and a long series which closely resembles *inflexaria*, Snellen, from Celebes.

Chogada proletaria, nov.

♂ ♀. Fore wing longer and narrower than is usual in the genus; outer margin more oblique. Upperside: fore wing of a uniform chocolate-brown colour, covered with dark brown irrorations; antemedial and postmedial dark brown lines crenulate and nearly erect; a black erect band across the middle of the wing near the postmedial line, the band with a thickening above its middle and an acute outward angle below its middle; a submarginal crenulate brown line; both the postmedial and submarginal lines outwardly edged with greyish white, some black points on the outer margin: hind wing slightly paler, but similarly coloured and irrorated; the costa broadly whitish, a black dot at the end of the cell; ante- and postmedial and submarginal curved pale brown lines, the last with some brown spots near the anal angle and some brown spots along the abdominal margin; the outer margin with black lunular line. Underside: fore wing grey, whitish on basal and hinder marginal portions, and a very large black spot at the end of the cell: hind wing tinged with ochreous on the blackish-brown border, occupying nearly one-third of the wing-space, with two pale spots on the outer margin; a black spot at the end of the cell, a pale brown antemedial thin band and some pale brown marks near the middle of the abdominal margin. Female greyish white irrorated with grey: upperside with the lines as in the male, but without the middle band on the fore wing, and with large grey spots ringed with brown at the end of the cell in both wings. Underside pale grey with large blackish cell-spots on all wings; broad blackish outer marginal borders with large marginal whitish spots.

Expanse of wings, ♂ ♀, $1\frac{7}{10}$ inch.

Hab. Singapore.

Boarmia clara, nov.

♂. Both wings pale pinkish brown, sparsely covered with minute brown atoms: fore wing with the costa thickly and unevenly irrorated with dark brown; a small brown spot at the upper end of the cell, with a brown ring round it; a dark brown sinuous line from the costa, one-fifth from the base, which does not reach the hinder angle; a brown, deeply denticulate, discal, transverse line, very deeply, outwardly curved, some darker brown irrorations beyond it: hind wing with a blackish-brown transverse line one-fifth from the base; beyond this line the wing is broadly covered with dense blackish-brown irrorations; the discal dentated line of the fore wing continued, outwardly curved, across the disc of this wing and some darker irrorations along the outer margin; both wings with black sinuous marginal line, with black spots in the interspaces. Underside uniform dull pale grey: fore wing with a rather large brown spot at the upper end of the cell, and a subapical brownish band: hind wing without any markings; antennæ, head, and abdomen of the ground-colour of the wings; thorax thickly irrorated with dark brown. Underside: body and legs concolorous with the wings.

Expanse of wings $1\frac{8}{10}$ inch.

Hab. Maymyo, Burma.

XXV.—*Descriptions of new Species of Lepidoptera from Africa and the East.* By G. T. BETHUNE-BAKER, F.L.S., F.Z.S.

RHOPALOCERA.

Lycænidæ.

LIPTENINÆ.

Alæna subrubra, sp. n.

♂. Both wings brownish black, with a curved postmedian yellowish stripe, interrupted at the veins; the secondaries have, in addition, two yellowish costal spots, two similar in the cell, and three on the inner margin. Under surface: primaries as above, with the addition of two yellowish spots in the cell, and beyond the curved postmedian stripe alternate rows of crimson and pale yellowish, two of each. Secondaries with alternate rows of dark crimson and pale yellowish, there being five rows of the latter, which are interrupted at the veins with crimson.

Expanse 30 mm.

Hab. Southern Sudan.

Type in Coll. Joicey.

LIPTENARA, gen. nov.

Eyes glabrous; antennæ short, rather fine, the strongly serrated club commencing with the fifteenth segment and occupying eleven segments; palpi minute, scaled. Neuration: primaries with vein 2 from the middle of the cell, 3 from well before the lower angle, 4 from the lower angle, 5 from the upper angle, 6 from behind the upper angle; 7, 8, and 9 stalked from well behind 6; 10 and 11 from the cell, the latter from behind the middle, *i. e.* nearer the base. Secondaries with 2 from behind the middle, 3 from well before the angle, 4 from the lower angle, 5 from the upper angle, 6 from behind the angle, 7 from behind 6.

Type, *Liptenara batesi*, B-B.

Liptenara batesi, sp. n.

Both wings orange-red; primaries with a broad black costa increasing in width; apex and termen very broad, the former with a broad, white, subapical, irregular bar. Secondaries with a broad black termen, very irregular on its inner margin. Under surface as above as regards the orange area, but the black area is much intercepted with white. Primaries with the costa interrupted with white spots and the white bar larger; termen with white radiations between the veins. Secondaries with large white marginal lunules between the veins, leaving only black spots at their bases.

Expanse 46 mm.

Hab. Bitje, Cameroons.

Type in Coll. Joicey.

Pentila petreoides, sp. n.

♂. Primaries with the cell deep sooty black, costa blackish to cell, beyond the cell narrowly black till it joins the very broad blackish termen; fold below cell with confluent blackish spots up to origin of vein 2; rest of wing deep straw-colour, almost yellowish. Secondaries yellowish straw-colour, with one or two blackish basal spots; a round blackish spot at the end of the cell and a broad black termen, on the inner margin of which the row of postmedian spots of the under surface shows through. Under surface: primaries with the dark termen and costa irrorated with dark brown, the cell darkly spotted. Secondaries finely irrorated all over, the termen darker; six dark spots around the cell, those at the end and above the cell being the largest; a curved row of seven spots following the outline of the dark termen.

♀. Similar to the male, but tawny in colour, whilst the cell of the primaries is spotted, not entirely black, and with a black spot below vein 3, and the broad dark costa is continuous into the dark apex and termen.

Expanse, ♂ 34, ♀ 36 mm.

Hab. Coomassie (Friapere Forest).

Types in Coll. Joicey.

Pentila fallax, sp. n.

♀. Allied to the previous species, but with the dark termen and costa very much broader in the primaries, and the termen of the secondaries broader and the colour orange-red. On the underside, in addition to the spots enumerated in the ♀, the postmedian row is transformed into a straight horizontal row of four spots from the inner margin of the secondaries, and there is an erect postmedian row of three spots in the primaries.

Expanse 38 mm.

Hab. Bitje, Cameroons.

Type in Coll. Joicey.

Pentila tricolora, sp. n.

♀. Both wings blackish brown, with a large postmedian orange patch, that in the secondaries taking the form of a very broad band, which irregularly invades the restricted dark base. The pattern of the underside is in the main the same, but the dark areas are spotted with buff colour, and, in addition, the secondaries have a regular marginal series of lunules, and the postmedian area is buff, not orange, outside which in the dark area is a curved series of seven spots.

Expanse 36 mm.

Hab. Bitje, Cameroons.

Type in Coll. Joicey.

Pseuderesia tripunctata, S. & K., and *Liptena dæmon*, H. H. D.

Smith & Kirby's species was described from specimens in Staudinger's collection (Rhop. Exot. p. 116, pl. xxv. figs. 3 & 4, 1894), and a few years afterwards Staudinger sent me specimens of it. It appears, however, so far as I can trace, to have been unknown in English collections until Bates sent his series home and Mr. H. H. Druce described both sexes under the appropriate name *dæmon*: I also received specimens of Bates's insects from Bitje, and was able to compare them with those from Staudinger's cabinet, and there is no question at all that they are the same species; up till Mr. Druce's description, however, the female was, I believe, unknown. It belongs to the genus *Liptena*, as assigned by my friend Mr. Druce; the name *tripunctata* has, however, many years' priority.

I have, however, not much doubt that Smith & Kirby's name ought also to sink before Holland's *O. rubrum* ('Psyche,' v. p. 425, 1890); the number of the red spots on the underside varies in my series, and I have specimens that fit both descriptions. *Pseuderesia catalina*, S. & K., which is a *Liptena*, is an exceedingly close ally.

Liptena durbania, sp. n.

♂. Both wings clear fawn-yellow. Primaries with broad dark costa and very broad dark apex, terminating finely about vein 2 on the termen. Secondaries with a trace of a dark termen in parts. Under surface: primaries as above, but the dark areas of the upperside only show through as darker patches. Secondaries buff-colour, with transverse bands of darker buff, viz., two antemedian interrupted bands, a median and postmedian springing from the same costal patch, and an anteterminal band.

Expanse 34 mm.

Hab. Bitje, Cameroons.

Type in Coll. Joicey.

This species is near *lukrines*, H. H. D., and has a tendency to mimic the genus *Durbania* in its general appearance.

Argyrocheila bitje, sp. n.

♂. Both wings pure white, with the margins finely pointed with black at the terminations of each of the veins; the primaries have a very restricted pale brownish apex. The underside has the cells closed with a small black dot that shows through; the primaries have several pale brown costal points and a dark point at the base of the cell; they have also a postmedian row of three widely separated pale ash-grey spots in the radial area. The termen is not crenulated at all.

Expanse 28 mm.

Hab. Bitje, Cameroons.

Type in Coll. Joicey.

At first sight this appeared to require a new genus, but the neuration is precisely the same, and the antennæ, palpi, and legs have likewise a similar structure.

Micropentila subplagata, sp. n.

♂. Both wings blackish, with fringes intersected with white. Secondaries with the costal three-quarters of the wing orange-yellow, extending downwards to well below the lower margin of the cell. Under surface: both wings blackish, with yellow patches and spots. Primaries with two small spots in the cell and a broadish stripe across the end of the cell to the inner margin, where a large patch is developed; an irregular series of four spots across near to the apex; termen with very fine internervular dashes. Secondaries with a basal patch, two antemedian ones, one large one beyond the cell, and a smaller one between veins 1 and 2; an irregular marginal series, more or less confluent, of six spots.

♀. Primaries with the median and inner marginal areas orange-yellow, with black spots in the cell and the costa and termen black. Secondaries as in the male, but the yellow extended right across the wing on to the inner margin, and two or three spots near the anal angle. Underside as in the male, but with the yellow markings much emphasized, especially in the primaries.

Expanse, ♂ 24, ♀ 22 mm.

Hab. Bitje, Cameroons.

Type in Coll. Joicey.

It has been very difficult to decide whether this species should be referred to the genus *Liptena* or *Micropentila*, the neuration of each being similar; the general appearance and the underside pattern fit in, perhaps, better with the latter than the former. There is little question that the Lipteninæ are in need of considerable revision.

Epitola subalba, sp. n.

♀. Both wings blackish, with blue areas. Primaries with the blue area extending from the base to just beyond the cell and to the inner margin; at the end of the cell there is a trace of a whitish spot. Secondaries with the blue area from the base between veins 2 and 6 to well beyond the end of the cell. Under surface: both wings white, spotless and without marks or lines except the subterminal grey lunulated line, edged externally by a fine grey line.

Expanse 48 mm.

Hab. Bitje, Cameroons.

Type in Coll. Joicey.

This species is allied closely to *nitide*, H. H. D., but I have described it as new because the underside pattern is almost universally similar in both sexes in the genus.

Hewitsonia kirbyi bitjeana, var. nov.

♂. Primaries: the blue of the ordinary form of *kirbyi* is changed into a very pale metallic green and is more restricted in area. Secondaries with the blue of *kirbyi* changed into white, over which there is a restricted area of very pale metallic green in the cell and very slightly beyond and on the fold, *i. e.*, around veins 1 and 2; the underside of the secondaries is also much whiter.

♀. Primaries with all the yellow markings changed to white. Secondaries with the radial area white, not brown. Underside: both wings with all the yellowish markings white and with no tawny bar or markings.

This is so well marked a form that it seems advisable to name it. It may be the wet-season form.

Æthiopana (*Epitola*) *honorius*, Fab.

Aurivillius has placed this species under the genus *Epitola*, and most, though not all, authors have recently followed his leading. That able observer depends practically upon the pattern of the wings when he separates *Hewitsonia* from *Epitola*, admitting that the neuration of the two genera is almost precisely the same. Hewitson was the first to separate the two, and he gave the name *Corydon* to the one; this, however, was preoccupied, so that Aurivillius renamed it *Hewitsonia, boisduvali*, Hew., being the type.

In neuration, however, *honorius* belongs to neither, as veins 7, 8, 9, and 10 are stalked on a strong well-developed stalk at some distance from the cell. I have a fair series of the species, and this is a constant and well-marked feature in its structure. This being the case, I propose the name *Æthiopana* for *honorius*, Fab.

Powellana cottoni, B-B.

This species was described by me (P. Z. S. Lond. p. 114, pl. ix. fig. 13, 1908) from the Upper Congo, and shortly afterwards was sent home by Bates from the Cameroons; it appears rather later to have come into Dr. Holland's hands from the Cameroons also, and he described it under the names *Satyrimima weberi* (Ent. News, xxiv. p. 302, figs. 1 & 2, 1913), both of which names must, I think, sink to mine; the insect is so remarkable that there is no possibility of mistaking it.

HETEROCERA.

Geometridæ.

Milionia hypercallima, nom. nov.

I described a species of *Milionia* under the name *callima* in this Magazine in 1910 (ser. 8, vol. vi. p. 453), but find that Rothschild & Jordan had previously used that name in the Novit. Zool. 1905, p. 467. I propose, therefore, *hypercallima* for my species instead of the name I originally used.

Chrysocraspeda callima, sp. n.

♂. Head, thorax, abdomen, and both wings mauve-grey, with a fine postmedian line, oblique in the primaries, slightly curved in the secondaries. The primaries have a dark point at the end of the cell. Fringes yellow.

Expanse 26 mm.

Hab. Dinawa, British New Guinea, 4000 feet; September (*A. E. Pratt*).

Type in my collection.

Near *C. croccomarinata*, Warr.

Chrysocraspeda dinawa, sp. n.

♀. Head yellowish, thorax and abdomen reddish. Both wings lemon-yellow with red markings. Primaries with basal area so closely covered with spots and stripes as to show but little of the yellow ground-colour; median area clear yellow except at the costa, where it is irrorated with red; a broad postmedian band of red patches; subterminal area yellow, with red irrorations and spots. Secondaries with a small red basal area; median area yellow. with a red spot at the end of the cell and the inner margin red; postmedian area red almost up to the termen in the lower radial area, but leaving in the upper radial area more of the yellow ground visible, which is spotted with red; termen spotted with red in both wings.

Expanse 24 mm.

Hab. Dinawa, British New Guinea, 4000 feet; August (*A. E. Pratt*).

Type in my collection.

Chrysocraspeda tricolora, sp. n.

♂. Head, thorax, and abdomen reddish. Both wings pale yellow, almost entirely covered over with dense irroration of Indian red. In the primaries an oblique median band and a couple of dashes on the termen are all that shows of the ground-colour, and the median band does not reach the costa. In the secondaries there is a small silvery-white spot at the end of the cell; the only ground-colour visible is an apical and an anal marginal dash and a very short marginal dash in the upper and lower radial areas.

Expanse 25 mm.

Hab. Dinawa, British New Guiuca, 4000 feet; May to July (*A. E. Pratt*).

Type in my collection.

Ptochophyle prouti, sp. n.

♂. Head, thorax, and abdomen pale ochreous. Both wings pale ochreous, finely irrorated with grey. Primaries with a dark point at the end of the cell. Secondaries with a white dot at the end of the cell and a dark dash on the inner margin, at a right angle with it, above the anal angle. There is rather more of the unirrorated ground-colour showing in the secondaries than the primaries.

Expanse 22 mm.

Hab. Dinawa, British New Guinea, 4000 feet; May to July (*A. E. Pratt*).

Type in my collection.

Chloroclystis novaguineana, sp. n.

♂. Primaries with basal area glaucous, intersected by a fine line of white, and followed by a broad uneven whitish band, on each side of which at the inner margin is a small dark spot; median area very broadly grey, the outer half of which is paler; postmedian band broadly whitish, followed by a pale glaucous area (somewhat interrupted with whitish) up to the termen; termen with fine dark interneural dashes. Secondaries whitish.

Expanse 23 mm.

Hab. Dinawa, British New Guinea, 4000 feet; August (*A. E. Pratt*).

Type in my collection.

Hastina subviridata, sp. n.

♀. Head and antennæ whitish, thorax and abdomen grey. Both wings rather transparent whitish, with grey stripes. Primaries with base very restricted white, followed by a broad irregular grey band; median area white, postmedian irregular broad band grey, with white points therein; this is followed by a broad white band (terminal area broadly grey) in which are two rows of white spots, the inner row being dots only, the outer row being larger. Secondaries with the basal area white, the rest of the wing having the pattern of the primary continued through it. Fringes white, intersected with grey.

Expanse 24 mm.

Hab. Dinawa, British New Guinea, 4000 feet; September (*A. E. Pratt*).

Type in my collection.

Pomasia hebe, sp. n.

♂. Head yellowish, thorax red, with yellow patagia, abdomen red. Both wings yellow, with red spots and patches. Primaries with basal area yellow, with traces of red marks; a broad median red band, dissected rather broadly in the middle by the yellow ground-colour, with the inner marginal area interrupted with yellow; a postmedian stripe of yellow tapering off as it nears the costa, and interrupting the subterminal broad red band, which is also interrupted by a crescentic yellow stripe; terminal area narrowly yellow, with red dots therein. Secondaries almost as the fore wings in pattern, the broad median red interrupted area being absent.

Expanse 22 mm.

Hab. Mount Kebea, British New Guinea, 3000 feet; March and April (*A. E. Pratt*).

Type in my collection.

Peridela ekeikei, sp. n.

♂. Head, thorax, abdomen, and both wings brownish ash-grey. Primaries with a fine dark brown subbasal line projected forwards in the costal area; the median dark brown line is oblique and is followed by a broad, whitish, oblique band irrorated with grey and edged outwardly by a dark brown line, which is projected outwards at vein 6 into a triangular costal patch; the area outside this dark line is broadly darkish and extends in a curve to the termen about vein 6, above and below which the terminal and subterminal areas are paler grey. Secondaries with the markings of the primaries mostly carried through, but there is no subbasal line and there is a dark dot in the cell.

Expanse 32 mm.

Hab. Ekeikei, British New Guinea, 1500 feet; March and April (*A. E. Pratt*).

Type in my collection.

Near *P. amplificata*, Warren.

Semiothesa polioteta, sp. n.

♀. Head and thorax grey, abdomen brownish. Both wings grey, with greyish lines and dark brown spots. Primaries with an angled subbasal line, the short stroke of the angle on the costa being dark; a similar median line and a somewhat similar but more oblique postmedian line; there is, however, a dark dash and spot above vein 5 and a curved, short, dark line above vein 6 to the costa; the areas between these lines are paler grey; a dark terminal dash is just below the apex. Secondaries with the markings of the primaries slightly modified carried through, but there is no subbasal line.

Expanse 28 mm.

Hab. Dinawa, British New Guinea, 4000 feet; August (*A. E. Pratt*).

Type in my collection.

Casbia strigaria, sp. n.

♂ ♀. Both wings ash-grey, with very numerous and very fine, short, darker lines, and with broad red stripes. Primaries with a subbasal and a median red line, the latter irregular and rather the broader; a dark point at the end of the cell; a broadish, nearly erect, postmedian red stripe, followed almost directly by a large clouded reddish patch, tapering down narrowly at the tornus. Secondaries with a median, a postmedian, and a subterminal reddish stripe, each broader than its predecessor, the last being very broad and indefinite, and showing but little of the grey ground-colour on either side of it.

Expanse, ♂ 25, ♀ 26 mm.

Hab. Dinawa, 4000 feet; September. Ekeikei, 1500 feet; March and April (*A. E. Pratt*).

Types in my collection, the ♂ being from Dinawa and the ♀ from Ekeikei.

Near *C. scardamiata*, Warren.

Hypochrosis pratti, sp. n.

♂. Head ash-grey, thorax and abdomen brown-grey, anal extremity yellow. Both wings brownish grey, with a median, broad, irregular, olive-green band, not reaching the costa and edged all round with a black line; in the primaries there is, in addition, a black costal spot above the green band and a subterminal, waved, dark grey stripe. In the secondaries there is only the subterminal stripe, which is broadly interrupted about veins 4 to 6.

♀. Both wings rich brownish, with the pattern almost as in the male, but the black markings are absent except for a trace of a dark dash above the green band in the primaries.

Expanse, ♂ 32, ♀ 43 mm.

Hab. Dinawa, British New Guinea, 4000 feet; August (*A. E. Pratt*).

Types in my collection.

Near to *H. cryptopyrrhata*.

Hypochrosis prouti, sp. n.

♂ ♀. Head, thorax, and abdomen palish grey, the latter with laterals and venter yellow. Both wings pale grey with a central oblique olive-green stripe. In the primaries the stripe is straight and above it is a wedge-shaped black costal spot, and nearer the apex is another similarly placed and shaped spot, but smaller; up to the first spot the costa is finely yellow. In the secondaries the green stripe is waved and is edged externally by a very definite black stripe about the same width as the green one.

Expanse, ♂ 42, ♀ 50 mm.

Hab. Ekeikei, Mount Kebea, British New Guinea, 4000 and 6000 feet respectively; March and April (*A. E. Pratt*).

Types in my collection, ♂ from Ekeikei, ♀ from Mount Kebea.

Ectropis cessaria, ab. *ochreocosta*, ab. nov.

♂. Head and collar umber-brown, prothorax ochreous grey, rest of thorax and abdomen brown. Primaries burnt-brown with the costa very broadly ochreous grey, almost up to the apex; a trace of a median line and of a spotted post-median one, a subterminal row of creamy dots terminating at the apex in a fine short curved dash. Secondaries burnt-brown with a submedian dark line and a dark spot at the end of the cell, beyond which is a broadish, indefinite, darkly irrorated, creamy band; a trace of a dotted creamy line in the subterminal area terminating in a creamy anal dash.

Expanse 52 mm.

Hab. Mount Kebea, British New Guinea, 6000 feet; March and April (*A. E. Pratt*).

Type in my collection.

Paradromalia ambigua, ab. *intermedia*, ab. nov.

♂. Head, thorax, abdomen, and both wings dull brown finely irrorated all over, with a marginal creamy patch just above the tornus and another on the inner marginal side of it on the primaries, whilst in the secondaries there is a faint trace of a creamy postmedian line, more pronounced on the inner margin than elsewhere.

Expanse 46 mm.

Hab. Ekeikei, British New Guinea, 1500 feet; March and April (*A. E. Pratt*).

Type in my collection.

Mr. Prout tells me that this form is intermediate between *albimaculata*, Warren, and *uniformis*, Warren.

Myrioblephara dinawana, sp. n.

♀. Both wings white with numerous darker lines and markings. Primaries with submedian, median, and postmedian dark lines, the area between the two former and near them being finely irrorated with grey; the postmedian line is irregular, angled and curved, and broadly blackish for its costal portion, where it is deeply angled outwards; in this area also the wing is closely irrorated up to the apex and slightly so near the tornus. The secondaries have median, postmedian, and subterminal lines, the latter indistinct, the two former with irrorations on their external edges; there are also small irrorated patches in the apical and tornal areas.

Expanse 25 mm.

Hab. Dinawa, British New Guinea, 4000 feet; September (*A. E. Pratt*).

Type in my collection.

This species is near *subtrita*, Warren.

Myrioblephara dinawa, ab. *mediobscura*, ab. nov.

♂. Similar to the type-form, but with the whole of the median area entirely filled in with dark brown, extending along the fold to the postmedian line.

Expanse 24 mm.

Hab. Dinawa, 4000 feet; September (*A. E. Pratt*).

Type in my collection.

Myrioblephara paralucidata, sp. n.

♀. Head, thorax, and abdomen densely irrorated with brown. Both wings whitish, irrorated with brown. Primaries with a broad subbasal brown band from costa to inner margin; a trace of a median irregular line, postmedian angled and waved line definite, beyond which the area is almost solid brown so dense are the irrorations up to the finely crenulated white subterminal line, beyond which the wing is closely irrorated with brown, except a central terminal spot which is white. The basal and median areas are less irrorated with brown. Secondaries with two median and postmedian lines, the two median are faint and broadish, the postmedian is fairly distinct with a broad external edging of pale brownish irrorations, the terminal area is broadly pale greyish brown.

Expanse 26 mm.

Hab. Dinawa, British New Guinea, 4000 feet; September (4000 feet).

Type in my collection.

I am greatly indebted to my friend Mr. Louis B. Prout for identifying my New Guinea Geometridæ and for his opinion on the preceding species, and it gives me pleasure to dedicate one or two to him.

Noctuidæ.

Sericia obalauæ, sp. n.

♂. Head and thorax umber-brown with darker bars, abdomen umber-brown with mauve irridescence. Primaries brown with basal and subbasal dark broadish interrupted lunulated bands; antemedian line double, somewhat crenulate, a small dark spot in the cell followed by the double median line, which is moderately straight though slightly oblique to vein 2, below which a deep indentation occurs towards the termen, the usual large ocellated spots occur in the radial area; the postmedian indefinite band is edged finely with paler brownish, and is followed by a broad band of iridescent brown, edged outwardly by a subterminal crenulated line. Secondaries with the median line sharply serrate, beyond which the bands follow exactly those of the primaries.

Expanse 88 mm.

Hab. Obalau Island, Fiji; June.

Type in my collection—a series.

Next to *S. simplex*.

Pterothysanidæ.

Hibrildes albopunctata, sp. n.

♂. Caput and frons yellow, antennæ black; thorax black, with whitish patagia and a yellowish-white dash on each side of the black central line; collar yellowish with a dark central dividing dash; abdomen sooty grey with yellowish segmental subdorsal spots. Primaries sooty black, with the radial area whitish from the costa to vein 2; apex and termen sooty black. Secondaries white with broad sooty-black terminal areas, in which is a row of six white marginal spots; cell closed by a blackish dash.

Expanse 58 mm.

Hab. Fort Jamieson, N.E. Rhodesia.

This may be a white local race of *H. ansorgei*.

Striphnopterygidæ.

Stybolepis aurivillii, sp. n.

Head and thorax cream-colour, abdomen yellowish. Primaries greyish white, with a broad stripe of black scales filling the cell and beyond it; an oblique curved stripe of similar scales in the postmedian area and a trace of a subterminal one much interrupted. Secondaries greyish white, with a slight patch of thin grey scales in the cellular area and a trace of a scaled greyish postmedial stripe.

Expanse 58 mm.

Hab. Fort Jamieson, N.E. Rhodesia.

Type in my collection.

Arbelidæ.

Lebedodes nigeriæ, sp. n.

Head, thorax, and abdomen velvety dark greyish brown. Primaries sooty brown with the usual reticulations, the most prominent of which are a median, waved, irregular, erect line; a postmedian oblique line excurved to vein 2, below which it is erect; a subterminal waved line. Secondaries greyish.

Expanse 51 mm.

Hab. Agbaja, N. Nigeria; August and September (*Cator*).

Type in my collection.

Next to *L. durbanica*, Hmpsn.

Lasiocampidæ.

Gastropacha bicrenulata, sp. n.

♂. Head, thorax, abdomen, and both wings dust-colour. Primaries with an irregular, interrupted, subbasal line and a strongly crenulated, fine, dark postmedian line projected outwards at veins 6 and 7. Secondaries rather darker than primaries, with a crenulated postmedian line. Both wings have a dark dot near the end of the cell.

Expanse 72 mm.

Hab. Fort Jamieson, N.E. Rhodesia; June.

Type in my collection.

Next to *undulifera*, Wlk.

Pachypasa jamiesoni, sp. n.

♂. Head and thorax dark rusty brown, antennæ paler; abdomen also paler rusty brown. Primaries dark rusty brown, with the neuration paler in the basal and median areas; a very broad tawny postmedian band evenly curved from just before the apex to the middle of the inner margin, edged with a double, serrated, fine, dark line on each side, and on the outer edge this line is preceded by a broadish, serrated, dark line; beyond the band is a narrow stripe of pale fawn-colour, following the same curved contour and followed by the terminal area, which is tawny for the apical half and ashy for the tornal half. Secondaries tawny rust-colour, darker outwardly and with a trace of a pale oblique median stripe.

Expanse 53 mm.

Hab. Fort Jamieson, N.E. Rhodesia; June.

Type in my collection.

Near *fulgurata* (Aurivillius).

Limacodidæ.

NAROSANA, gen. nov.

♂. Palpi porrect, hairy, end-segment minute, depressed; antennæ shortly ciliate; legs heavily scaled, mid and hind legs spurred. Wings short and broad, primaries with costa straightish, termen evenly curved, inner margin with a scaled lobe near the base; secondaries with the termen somewhat truncate. Neuration: primaries with vein 2 from two-fifths before the lower angle of the cell, 3 from well before the angle, 4 from the angle; all the veins highly concave, 5 from just above the angle and convex, 6 from the middle of the discocellulars; 8, 9, and 10 stalked on a longish stalk from the upper angle; 11 from the cell, shortish. Secondaries with vein 2 from beyond the centre, 3 from before the lower angle, 4 from the angle, 5 from above the angle, 6 and 7 stalked on a long stalk.

Type, *Narosana agbaja*, B-B.

Narosana agbaja, sp. n.

♂. Head, thorax, abdomen, and primaries pale ochreous grey, the latter with a single small spot at the end of the cell; secondaries pale straw-colour.

Expanse 21 mm.

Hab. Agbaja, N. Nigeria; August and September (*Cator*).

Type in my collection.

This genus is near *Trachyptena*, B-B.

OIDEMASKELIS, gen. nov.

Palpi upturned, end-segment minute; antennæ pectinate for the central area; legs longish, front pair with the coxæ and femora much swollen, mid-pair with the femora and tibiæ swollen. Wings short and broad; primaries with the costa slightly curved near the base then straightish, apex subacute, termen arched, inner margin well excurved. Neuration: primaries with vein 2 from a third before the lower angle of the cell, 3 from well before the angle, 4 from the angle, 5 from well above the angle, 6 from just above the middle of the discocellulars, 7 from immediately below the upper angle; 8, 9, 10 stalked, 8 and 9 from near the apex, 10 from the upper angle with 8, 11 from the cell. Secondaries with 4 from the lower angle, 6 and 7 stalked on a very long stalk.

Type, *Oidemaskelis eurota*, B-B.

Oidemaskelis eurota, sp. n.

♂. Head, thorax, abdomen, and primaries dirty rust-colour, with a somewhat darker indefinite cloud in the median area. Secondaries subhyaline, pinkish grey.

Expanse 20 mm.

Hab. Fort Jamieson, N.E. Rhodesia; September.

Type in my collection.

This genus would appear to be near *Orthocraspeda*, Hmpsn.

SCIRRHOMA.

Head small, smoothly haired; palpi porrect, hairy, third segment but little shorter than second; antennæ long, serrate, finer in ♀ than in ♂. Legs long, hairy, mid-pair with minute spur. Primaries long, of but moderate width; costa slightly arched, with subacute apex; costa receding, slightly rounded. Secondaries longish; costa slightly excised, apex subacute; termen with a slight angle about vein 3, this in specimens with a perfect fringe has the appearance of being only rounded. Neuration: primaries, vein 2 from a third before the lower angle of the cell, 3 midway between 2 and the angle, 4 from the lower angle, 5 from a little above the angle, 6 from the middle of the discocellulars; 7 and 8 from the upper angle of the cell, stalked near the apex; 9 absent; 10 and 11 from the cell, long; 12 long, reaching well beyond the end of the cell, which (the cell) is very long, extending decidedly over half the length of the wing. Secondaries with vein 2 from two-fifths before the lower angle of the cell, 3 from well before the angle, 4 from the angle, 5 from a little above the angle, 6 and 7 stalked from well beyond the upper angle, 8 long. Frenulum of the ♂ ending in a clubbed apex, ♀ with each of the separate hairs slightly clubbed or spatulate, so that when closed together they also form a club.

Type, *Scirrhoma ethiopica*, B-B.

Scirrhoma ethiopica, sp. n.

♂ ♀. Primaries uniform dull brown. Secondaries pale orange-yellow with the outer margin broadly black tapering narrowly to the anal angle. Thorax and head similar in colour to the primaries; abdomen as the secondaries. The female is uniformly paler than the male.

Expanse, ♂ 38, ♀ 42 to 46 mm.

Hab. Fort Jamieson, N.E. Rhodesia; December 1906.

Types in my collection: one ♂ and three females.

In this species the separate hairs of the frenulum are slightly thickened at the extremity, forming a slight club when lying together.

Scirrhoma callima, sp. n.

♂ ♀. Head bright chestnut-red, palpi black with a basal bar of chestnut-red below; antennæ black with a restricted basal area of chestnut-red; pectus and legs orange-red; thorax bright chestnut-red, with a lateral creamy dash on each side; abdomen chestnut-red, with paler segmental divisions. Primaries satiny buff, the gloss is of a beautiful but almost indescribable tone of colour; a very oblique bright chestnut stripe runs from the apex to the inner margin on the basal side of the centre, fringes chestnut-red. Secondaries clear orange-yellow, with a slight sheen.

Expanse, ♂ 42–47, ♀ 58 mm.

Hab. Lagos; ♀ Gold Coast.

Types: ♂ in the Oxford Museum from Lagos (*Dr. Lamborn*), ♀ in the British Museum from the Gold Coast.

The frenulum of the ♀ has spatulate extremities to the hairs and forms a largish club.

Scirrhoma lamborni, sp. n.

♀. Head and thorax orange-red; palpi orange-yellow, end-segment black below; antennæ black; abdomen orange.

Both wings orange-yellow, the secondaries not so bright as the primaries, both having a broad outer margin of neutral-grey, tapering somewhat narrower at the tornus.

Expanse 50 mm.

Hab. Lagos, West Africa; December 8th.

Type in the Oxford Museum.

XXVI.—*On* Elporia, *a new Genus of Blepharocerid Flies from South Africa.* By F. W. EDWARDS, B.A., F.E.S.

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IN the 'Annals and Magazine of Natural History' for June 1912, I described under the name *Kelloggina barnardi* the only species of Blepharoceridæ which has yet been recorded for the Ethiopian region. At the time of writing, the insect appeared to me to possess all the main characters of the genus *Kelloggina*, but, as will now be shown, the South African species must be excluded from that genus on account of an important difference in the structure of the eyes.

I was led to make a more careful examination of *K. barnardi*, on account of a suggestion made by Prof. M. Bezzi, in his paper "Blefaroceridi Italiani" (1913), that the larvæ described as *K. barnardi* did not belong to the same species as the adults, as these larvæ appeared to him to be related to *Blepharocera* *. The specimens on which the original description of *K. barnardi* was founded, being for the most part newly hatched, were somewhat shrivelled, and, under a dissecting-microscope, there was no evidence of any division of the eyes into two portions, as in many genera of this family. This was only what was to be expected, as the wing-venation of the new species was practically identical with that of *Kelloggina* and *Paltostoma*, the latter of which at least undoubtedly has simple eyes. When, however, specimens of *K. barnardi* were boiled in potash, it was at once evident that the eyes were very distinctly divided into upper and lower portions †, although, as there was very little difference in the size of the facets of the upper and lower portions, it was only when the eyes were unshrunken that their real structure was discernible. Subsequently I received larvæ and pupæ of a second species of South African Blepharoceridæ, and when, acting on a suggestion made to me by Mr. H. Scott, I dissected out imagos from the pupæ of this form and of *K. barnardi*, I found that here again the eyes were of the same type, though there were extremely interesting differences between the two forms which will be described below. It thus appears that these South African species form to some extent a connecting-link between the South American *Kelloggina* and the European *Apistomyia*, resembling the former in wing-venation and the latter in the structure of the eyes. Dr. A. Lutz informs me that he has recently obtained both sexes of a species of true *Kelloggina* in Brazil, and that in both males and females the eyes are simple. As the condition of the eyes is (doubtless correctly) regarded as a character of generic importance in this family of flies, it becomes necessary to form a new genus for *K. barnardi* and the new species referred to. I propose the term *Elporia* *, which may be defined as follows:—

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* As has recently been shown by Scott, this suggestion was unfounded.

† Scott has recently stated that the contrary is the case, but his observation was made on a badly-mounted specimen.

ELPORIA, gen. nov.

Imago: Eyes dichoptic, hairy, divided by a horizontal band into two distinct parts. Antennæ 14- or 15-jointed. Mouth-parts similar in the two sexes; mandibles absent; maxillæ well developed, but without cutting-teeth, as long as the first joint of the palpi; palpi three- or four-jointed, longer than the proboscis by fully the length of the last joint; first joint longer than the others. Proboscis as long as or longer than the vertical diameter of the head. Wing-venation as in *Paltostoma*. Front and middle tibiæ without spurs, hind tibiæ with one large spur. Last tarsal joint without any group of spines at the base. Claws usually elongate, with several spines on the underside, sometimes partly pulvilliform.

Pupa: Integument smooth; respiratory horns each composed of four flattened lamellæ, the two inner much narrower and rather shorter than the two outer.

Larva: Antennæ rather short, two-jointed. Integument provided with more or less distinct short spines, the largest of which are arranged in a definite way, two occurring near the anterior border, four near the posterior border, and one at each side of each of the five intermediate segments. Six pairs of hairy lateral processes. Five pairs of gill-tufts, each of which is composed, in the fully-grown larva, of five filaments, which arise practically co-basally. Two pairs of more or less spherical anal papillæ. Mouth-parts and suckers rather closely resembling in structure those described by F. Müller.

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* From ἐλπωρή, hope.

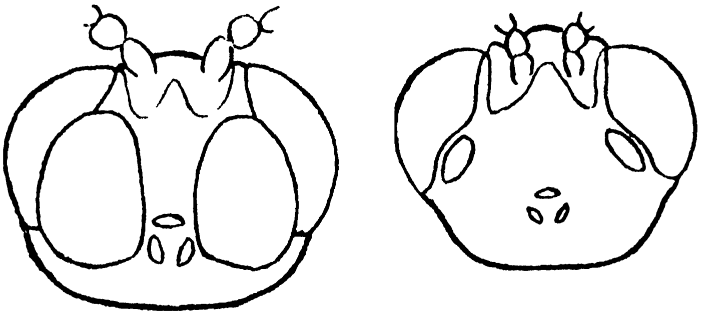
Type-species. *Kelloggina barnardi*, Edwards (1912).

The genus differs from *Paltostoma*, to which in many respects it is obviously related, as follows:—the longer male palpi, the absence of female mandibles and the shorter proboscis, the divided eyes, and in the structure of the last tarsal joint; in the different arrangement of the spines of the larva, the smaller number of gill-filaments in each tuft; and in the different anal papillæ. To *Kelloggina* it is more closely related, the only important difference which can at present be pointed out being in the divided eyes. Other differences, however, will probably be found when more information is available as to the structure and life-history of *Kelloggina*.

1. *Elporia barnardi*, Edw.

As my original description of the head of *K. barnardi* was incomplete and inaccurate in several respects, it is necessary to give a redescription. In the first place, it must be stated that in the figure of the female fly (Ann. & Mag. Nat. Hist. ser. 8, vol. ix. pl. xx. fig. 1, 1912), the head depicted is really that of the male and not the female, the latter sex having a much broader front and larger terminal joint to the antennæ.

Fig. 1. Fig. 2.



Elporia barnardi.

Fig. 1.—Head of male; diagram showing division of the eyes.
Fig. 2.—Head of female, to show the same.

The eyes in both cases are dichoptic, the front, however, being fully twice as broad in the female as in the male. Pubescence rather short, being only about as long as the width of two facets. In the male the eyes are divided by a horizontal line (it is too narrow to be called a band) into an upper and a lower portion; the upper is nearly two-thirds the size of the lower and its facets are very slightly larger. In the female also the eyes are divided, but in this sex the upper portion is very much smaller than the lower, and its facets are very markedly smaller. The antennæ are 15-jointed in *both* sexes (my previous statement that the female antennæ were only 14-jointed was incorrect); in the male the joints of the flagellum are all very much of the same size and nearly globular; the female antennæ are similar, except that the terminal joint is distinctly enlarged and more oval. The palpi are four-jointed, but the division between the last two joints is not well marked, so that in some mounted specimens they appear to be only three-jointed. The first joint is the longest, being slightly longer than the second and third taken together; the second and fourth are each a little longer than the third. The second joint has on its internal-ventral aspect a circular pit, the floor of which is occupied by a sense-organ, the structure of which is difficult to make out. Under a low magnification this pit appears as a dark patch. A very similar structure has been described by Scott in the second joint of the palpi of *Paltostoma*, while organs differing to some extent from these, although evidently homologous, occur in the Simuliidæ, Mycetophilidæ, and Rhyphidæ*. The labium has precisely the same structure in the two sexes; there are scattered stiff-pointed hairs all over it, and,

Fig. 3.

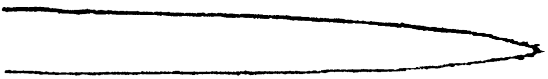
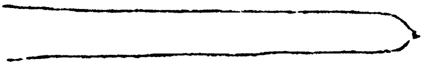


Fig. 4.



Elporia barnardi.

Fig. 3.—Labrum.
Fig. 4.—Hypopharynx.

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* These organs were first described by Wesché (Biol. Bull. vol. xxiii. 1912, p. 267).

Fig. 5.

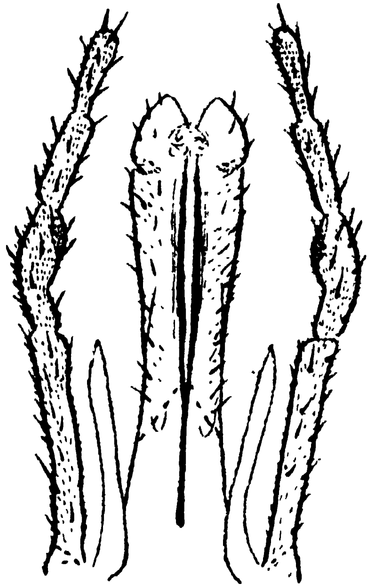


Fig. 6.

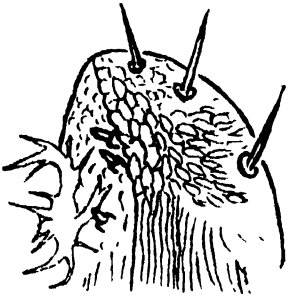


Fig. 7.

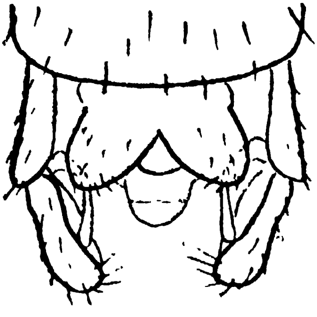


Fig. 8.

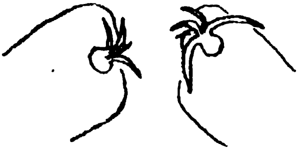


Fig. 9.

Elporia barnardi.

Fig. 5.—Maxillæ and labium.
Fig. 6.—Tip of labellum, more highly magnified.
Fig. 7.—Genitalia of male, dorsal view.
Fig. 8.—Anal armature of larva.
Fig. 9.—Spiracle of larva.

in addition, at the tip of the labella there are two or three very short blunt "spines," closely resembling the "taste-hairs" which have been described by Wesché and others in a variety of insects. The labella themselves have a beautiful "honey-combed" structure.

The outer lamellæ of the pupal respiratory horns are somewhat triangular, about half as long again as the breadth of the base, and bluntly pointed. The inner lamellæ are a little shorter, rounded at the tip, but not at all tapering, and only about one-third as wide as the base of the outer lamellæ.

The larvæ have small spines on their dorsal surface, arranged on the same plan as in *E. capensis*, though they are much less conspicuous; there are no spines on the lateral processes. As noticed by Scott in *Paltostoma*, the number of filaments in the branchial tufts increases with the age of the larva; the small larvæ have three in each tuft, the fully-grown specimens have five. The form of these tufts is the same as in *E. capensis*. I have seen no first-stage larvæ, and cannot therefore say whether these have less than three gill-filaments. The extreme tips of the hairy lateral processes are bifid on the underside, a character which is also to be noticed in *E. capensis*, though apparently it does not occur in *Paltostoma*.

The spiracles are present in the same positions as in *Paltostoma*; they appear simply as chitinous rings. The anal papillæ are subequal in size; hidden by them, but plainly visible in a mounted specimen, is the anal armature.

Mr. K. H. Barnard has kindly supplied me with some notes on the seasonal occurrence of *E. barnardi* in Platteklip Gorge. His records are as follows:—

"3. ix. 1911. Full-grown larvæ.
"8. x. 1911. Pupæ, imagos.
"2. i. 1912. 1 full-grown larva, pupæ, 1 imago.
"5. viii. 1912. Various-sized larvæ from 2 mm. to full-grown; pupæ.
"16. ii. 1913. No larvæ or pupæ.
"22. vi. 1913. Larvæ 2–3 mm.
"2. viii. 1913. Larvæ 2–4 mm. A few pupæ.

"There would seem to be three broods a year at least, but with so many gaps one cannot state positively."

Mr. Barnard has also found *E. barnardi* "in the suburbs of Cape Town, at a level above the sea of not more than 200 ft., in a swiftly-running stream from the mountain, but not in any sense a precipitous mountain-stream; the larvæ and pupæ are attached to boulders."

2. *Elporia capensis*, sp. n.

Early in 1914 I received larvæ and pupæ of a Blepharocerid taken near Stellenbosch, Cape Province, U. S. Afr., at an altitude of about 500 feet. These were obviously distinct from *E. barnardi*, but, as no adults were received with them, they were put on one side as temporarily indeterminable. Recently, however, I have dissected out two examples of each sex from these pupæ, and these specimens are in such an advanced stage of development that it is possible to give a fairly complete description of their structural characters, though, of course, nothing can be said concerning coloration. This, however, is an omission of small importance, and, as the species shows several interesting and rather remarkable differences from *E. barnardi*, it seems desirable to take this opportunity of describing it.

Imago: front of the *same width in the two sexes*, narrower than that of the female, but broader than that of the male of *E. barnardi*. Eyes *in both sexes* divided into two portions, of which the upper is a little larger than it is in the female of *E. barnardi*; *in both sexes* the facets in this upper portion are slightly smaller than they are in the lower. Pubescence of eyes longer than in *E. barnardi*, about as long as the width of three facets. Antennæ fourteen-jointed in both sexes, the second scapal and the first two or three flagellar joints about half as long again as broad, the first-named being considerably enlarged apically; the remaining joints more or less globular; there is no marked sexual difference in the size of the terminal joint, though, if anything, it is a little longer in the male than in the female. Proboscis only about as long as the vertical diameter of the head. Labrum of quite a different shape to that of *E. barnardi*, with no hairs at its tip; the hypopharynx, on the other hand, has a slightly hairy tip like that of the labrum of *E. barnardi*. *Palpi three-jointed*, longer than the proboscis by the length of their last joint; first joint as long as the last two combined; last two equal in length; second joint with a circular pit as in *E. barnardi*. Labium rather stouter than in *E. barnardi*, the labella without any "taste-hairs" at the tip, and without a distinct honeycombed structure.

The genitalia, as in *E. barnardi*, and as Dr. Lutz informs me is the case in *Kelloggina*, are not very dissimilar at first sight in the male and female. Their structure is shown in the figures (figs. 13 & 14). The female has three *receptacula seminis*.

The hind tibiæ, as in *E. barnardi*, have a single spur at

Fig. 10.

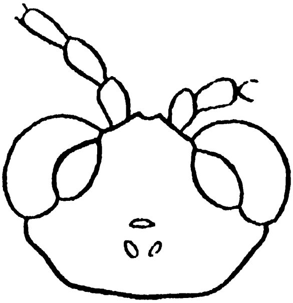


Fig. 11.

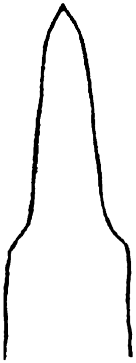


Fig. 12.

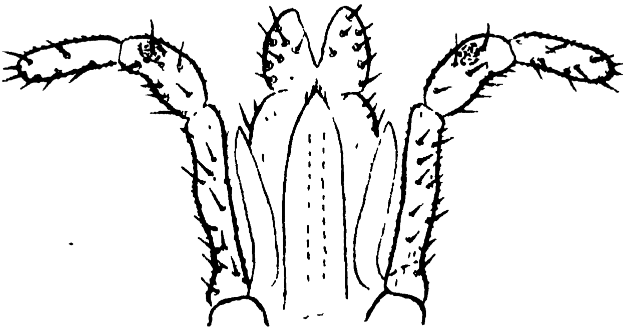
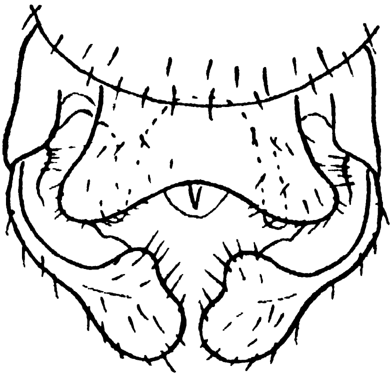


Fig. 13.



Elporia capensis.

Fig. 10.—Head, male or female, showing division of eyes.
Fig. 11.—Labrum.
Fig. 12.—Hypopharynx, maxillæ, and labium.
Fig. 13.—Genitalia of male.

Fig. 14.

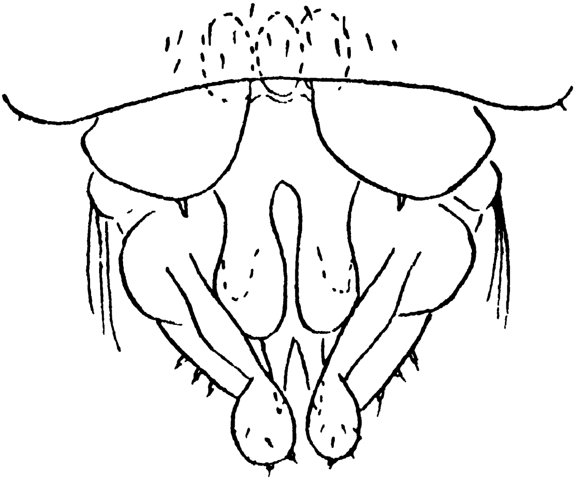


Fig. 15.

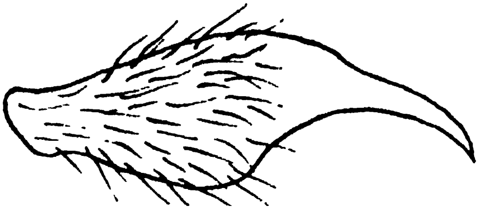
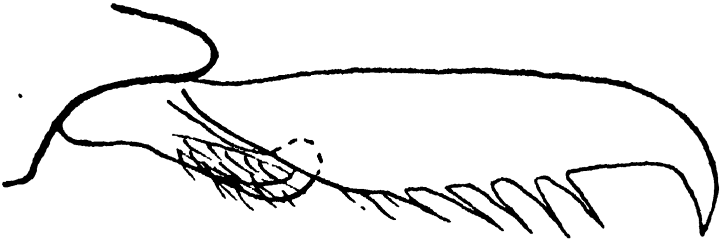


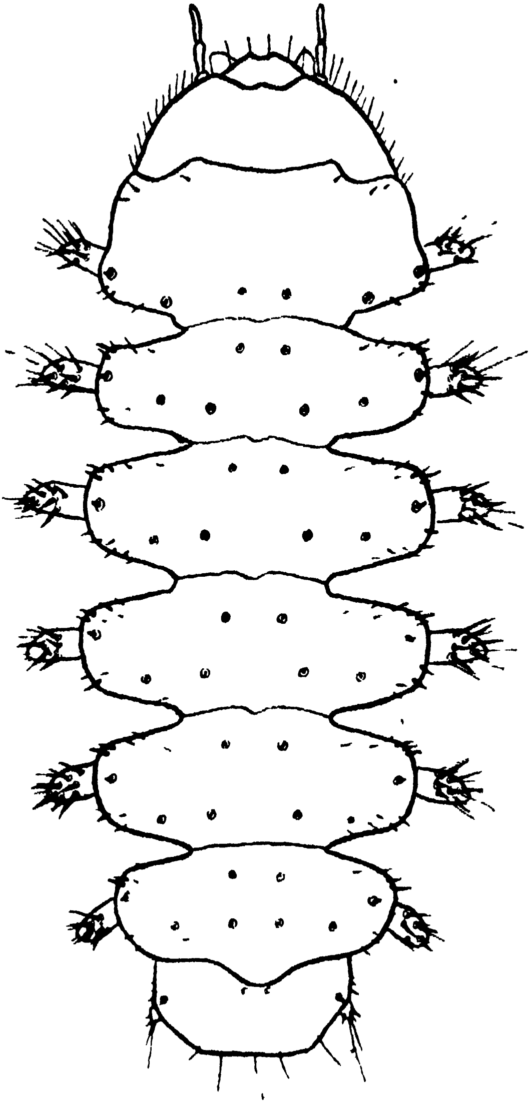
Fig. 16.



Elporia capensis.

Fig. 14.—Genitalia of female
Fig. 15.—Claw of male.
Fig. 16.—Claw of female.

Fig. 17.



Elporia capensis

Larva, dorsal view, showing arrangement of the spines.

Fig. 18.

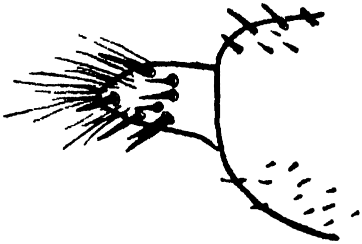


Fig. 19.

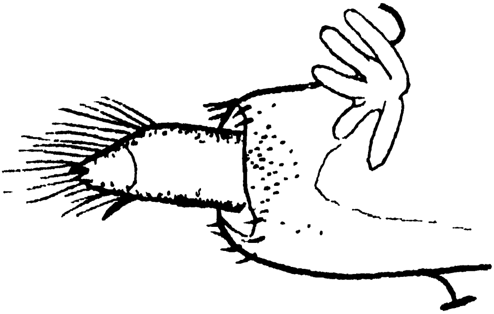


Fig. 20.

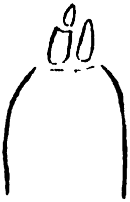


Fig. 21.

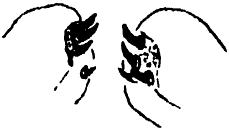
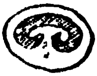


Fig. 22.



Elporia capensis.

Fig. 18.—One of the lateral processes of the larva, more enlarged; dorsal view.

Fig. 19.—The same, ventral view, to show form and position of gill-tuft.

Fig. 20.—Tip of antenna of larva.

Fig. 21.—Anal armature of larva.

Fig. 22.—Spiracle of larva.

the tip. The proportions of the tarsal joints are much the same as in *E. barnardi*, except that the first and fifth joints are relatively a little longer; the first joint is as long as the next three taken together; the second, third, and fourth gradually decrease in length, while the fifth is as long as the third and fourth combined. The male claws are swollen towards the base, with a thin curved tip; the basal portion is densely hairy, almost pulvilliform, but there are no spines on the underside. The female claws, on the other hand, rather closely resemble the male claws of *E. barnardi* in shape and in possessing several sharp spines on the underside. The male claws are very interesting, as exhibiting some approach to the abnormal pulvilliform claws of the male *Hapalothrix lugubris*.

The wing-venation is apparently the same as in *E. barnardi*, although it is very difficult to make out in detail, owing to the crumpled condition of the wings.

Pupa of a somewhat different shape from that of *E. barnardi*; the portion in front of the respiratory horns descends less steeply (at an angle of about 45° instead of about 60°). The respiratory horns closely resemble those of *E. barnardi*.

Larva in all essential features resembling that of *E. barnardi*, but much more spiny, the largest and most conspicuous spines occurring on the lateral "pseudopodia." As in the case of *E. barnardi*, the young larvæ have three, the full-grown ones five, gill-filaments in each tuft. There is a small, slightly spiny, lateral projection on the anal segment, which in *E. barnardi* is hardly present, being represented by the merest knob; from this projection or knob arise in both species two long hairs, springing from a common base; these hairs are rather longer and more conspicuous in *E. barnardi* than in the new species. The spiracles are present, as in *E. barnardi*, and have a more complicated structure. The two pairs of anal papillæ are very unequal in size and the anal armature differs from that of *E. barnardi*. The tip of the antennæ bears two small appendages, one of which is two-jointed.

Summary and Conclusions.

1. It has been found necessary to found a new genus, *Elporia*, for *Kelloggina barnardi* on account of the divided eyes. This genus differs from most Blepharoceridæ in that the females, like the males, have no mandibles.

2. A new species of this genus is described, differing markedly from *E. barnardi* in all its stages.

3. The larva of the new species, even more than that of *E. barnardi*, resembles that of *Paltostoma*. Both species, however, differ from *Paltostoma* in the form of the branchial tufts, which seems to strengthen the view that these organs are valuable for purposes of classification.

4. The arrangement of the larval spines appears to be a matter of considerable constancy, and, therefore, systematic importance.

XXVII.—*The* Xylophilidæ *of Ceylon.*

By G. C. CHAMPION, F.Z.S.

MR. G. E. BRYANT having kindly lent me his series of the Coleopterous family Xylophilidæ from Ceylon, named by Pic in 1912, the opportunity is taken of describing some additional species from the same island, mainly obtained by Mr. G. Lewis in 1881–1882. The types of the new forms, including the two detected in Mr. Bryant's collection, are all contained in the British Museum. Twenty-one Xylophilids are now known from the Island, four only of them having been identified from other Indian localities. Kandy, it may be noted, is at a much lower level (1546–1727 ft.) than the places where Mr. Lewis's insects were obtained.

HYLOBÆNUS, Pic.

Hylobænus fasciatus.

Hylobænus fasciatus, Pic, Ann. Soc. Ent. Fr. 1912, p. 272.

Hab. CEYLON, Galle [type]; TENASSERIM, Tavoy.

The type of this species was captured by Mr. Bryant at Galle on July 1st, 1908. There is another example of it in the British Museum, found by Doherty, at Tavoy, this latter having the intermediate and posterior femora and tibiæ almost black, but differing in no other respect from the somewhat immature type, which has the intermediate legs (the knees excepted) testaceous. Both appear to be females. The completely connate first two ventral segments is an additional character for the genus *Hylobænus.*

EUXYLOPHILUS, gen. nov.

Antennæ with joints 5–10 flattened, dilated, and serrate, 3 narrow, cylindrical, longer than 2 or 4; eyes feebly emarginate; prothorax longer than broad, subovate; elytra very elongate; the other characters as in *Xylophilus*, Latr.

Type, *E. principalis.*

The single species from which the above characters are taken is so different from all the Xylophilids known to me that it seems necessary to treat it as a separate generic type. *E. principalis* might even be mistaken for a small Lagriid.

Euxylophilus principalis, sp. n.

Very elongate, narrow, shining; nigro-piceous, the elytra with an elongate streak running down from the shoulder, a minute spot between it and the suture, and two small, oblong, confluent spots on the disc before the apex, the palpi at the base, the anterior legs (the slightly darker tarsi excepted), the intermediate legs with the femora at the base and the knees and tarsi, and the apices of the posterior tarsi, testaceous; the antennæ black, with the apical joint yellow; clothed with an extremely fine, adpressed pubescence, giving a pruinose appearance to the surface; densely, finely punctate, the punctuation becoming a little more diffuse on the elytra. Head convex, much wider than the prothorax, considerably developed behind the eyes, the latter large and separated by the width of one of them; antennæ moderately long, joint 3 twice as long as 2, narrow, 4 a little shorter and wider, subtriangular, 5–10 not or very little longer than broad, 11 ovate, longer than 10, obliquely acuminate. Prothorax narrow, longer than broad, rounded at the sides, and feebly constricted before the base, the disc with a transverse depression behind. Elytra very elongate, narrowed anteriorly and at the base not much wider than the head, the post-basal depression deep, transverse. Legs long, the anterior and intermediate pairs slender, the posterior pair much stouter, the latter with moderately incrassate simple femora and flattened rather broad tibiæ; tarsi with their antepenultimate joint somewhat broadly lobed, the posterior pair as long as the tibiæ.

Length 3⅘ mm. (♂?).

Hab. CEYLON, Dikoya, between 3800 and 4200 ft. (*G. Lewis*).

One specimen, in beautifully fresh condition, captured on Dec. 20th, 1881.

XYLOPHILUS, Latr.

Xylophilus palliditarsis.

Hylophilus palliditarsis, Pic, Ann. Soc. Ent. Fr. 1912, pp. 274, 279.

♂. Head with a transverse arcuate excavation at the base above, limited on each side behind by a tuberculiform prominence, and bearing a small dense cluster of flavous pubescence in the middle; anterior tibiæ mucronate at the inner apical angle; intermediate femora armed with a broad triangular tooth at the apex beneath.

Hab. CEYLON, Kandy.

Mr. Bryant's collection contains four males and one female of this species. It may be known by the broadly rufescent sides of the elytra, the very long antennæ and legs, the flavo-testaceous tarsi, and the extraordinary form of the head in the ♂. The antennæ have joint 3 a little longer than 2 and much shorter than 4, 4–10 being subequal in length. The ♂ cephalic armature was overlooked by Pic. *X. planipennis*, Motsch., if it has been rightly identified by me, is a very different insect.

Xylophilus dentatifemur.

Hylophilus dentatifemur, Pic, Ann. Soc. Ent. Fr. 1912, pp. 272, 279.

♂. Anterior tibiæ armed with a sharp triangular tooth at the middle within and also feebly mucronate at the inner apical angle; intermediate femora narrowly lamellate at the apex beneath and armed with a slender sharp tooth before the tip; [posterior legs wanting].

Hab. CEYLON, Kandy.

The unique example described is incorrectly stated to have the anterior (instead of the posterior) legs missing: the characters given for the other legs are therefore misapplied by the author. The antennæ are long and comparatively stout, and have the joints 3–10 subequal in length, 2 being much shorter.

Xylophilus planipennis.

Euglenus planipennis, Motsch. Bull. Mosc. 1863, i. p. 518.

Elongate, shining; piceous or fuscous, the palpi, the base and tip of the antennæ, the tarsi, the intermediate tibiæ at the apex, and sometimes the anterior femora and tibiæ also, testaceous or flavo-testaceous, the humeri usually with a reddish spot; clothed with an extremely fine, adpressed, greyish pubescence, giving a dull leaden appearance to the surface; the head and prothorax densely, finely, the elytra a little more diffusely, punctate. Head a little broader than the prothorax, transverse, rather convex, obliquely narrowed behind the eyes, the latter large and separated by about the width of one of them; antennæ slender, moderately long in ♂, shorter in ♀, joint 2 short, oblique, 3–6 subequal in length, each about twice as long as 2 in ♂, 7–10 gradually decreasing in length, 4–10 feebly subserrate, 11 ovate and obliquely acuminate. Prothorax subquadrate, obliquely narrowed anteriorly and slightly constricted at about the middle, the disc with an arcuate depression before the base and a shallow transverse groove in front of it. Elytra long, nearly twice as wide as the prothorax, subparallel in their basal half, flattened, the disc with a large, deep, oblique impression below the base. Legs long, slender, the posterior femora moderately thickened.

♂. Anterior tibiæ slightly hollowed towards the apex within, and also perceptibly curved; anterior tarsi dilated, the basal joint much thickened; posterior femora with a narrow, pallid, pad along their lower face, bearing a dense fringe of short flavo-testaceous hairs.

Length 2⅔–3 mm. (♂ ♀).

Hab. CEYLON (*ex Mus. Murray*; *G. Lewis*), Nuwara Elia.

Two males and several females, the sexes identified by Mr. Lewis, whose specimens were captured in Dec. 1881 or Feb. 1882. There can be little doubt that the insect before me is the imperfectly described *X.* (*Euglenus*) *planipennis* from Nuwara Elia [Nura Ellia].

Xylophilus testaceipennis.

Euglenus testaceipennis, Motsch. Bull. Mosc. 1863, i. p. 518 (nec Pic, 1912).

♂. Moderately elongate, shining; nigro-piceous, the antennæ, palpi, tarsi, anterior femora and tibiæ, and the other femora and tibiæ at the base and apex, testaceous, the elytra testaceous, with the suture at the base and apex and the outer margin narrowly infuscate; clothed with rather long, pallid, shaggy pubescence. Head transverse, much broader than the prothorax, narrowly extended on each side behind the very large eyes, which are separated by about half their width, closely punctate; antennæ moderately long, not very stout, joints 3–10 subequal in length, subcylindrical, 2 much shorter than 3, 11 stout, as long as 9 and 10 united, obliquely acuminate. Prothorax subquadrate, narrowed in front, densely punctate, without depression. Elytra moderately long, much wider than the head, subparallel to about the middle, more coarsely and more diffusely punctured than the prothorax, the disc with a long, deep, oblique depression below the base. Legs long; anterior tibiæ slender, abruptly bent inwards towards the apex (much as in *X. cribricollis* = *mucronatus*, Pic), and feebly mucronate at the inner apical angle; intermediate tibiæ moderately, and the posterior tibiæ strongly, clavate, the latter simple; tarsi rather slender.

Length 2⅓, breadth 1 mm.

Hab. CEYLON, Dikoya, between 3800 and 4200 ft. (*G. Lewis*), Nuwara Elia.

One male, taken on Jan. 12th, 1882. This insect agrees very nearly with the description of *X.* (*Euglenus*) *testaceipennis*, Motschulsky, from Nuwara Elia [Nura Ellia]; but it is not the species identified as such by Pic, which has the ♂ anterior tibiæ infuscate and feebly sinuate within, &c. The length is given as ¾ (which may be due to the head being deflexed in the type) and the breadth ⅖ lin.

Xylophilus crassipes, sp. n.

Hylophilus testaceipennis, Motsch., var., Pic, Ann. Soc. Ent. Fr. 1912, p. 280.

♂. Moderately elongate, shining; black, the palpi and tarsi, the femora at the base, the intermediate and posterior tibiæ at the base and apex, and the basal margin of the prothorax testaceous or rufo-testaceous, the elytra testaceous, with the sides rather broadly infuscate, the antennæ obscure testaceous, becoming paler towards the tip, the anterior tibiæ also infuscate; clothed with rather long cinereous hairs. Head very broad, transverse, finely punctate, narrowly extended on each side behind the eyes, the latter very large, coarsely facetted, and separated by about half their width; antennæ stout, moderately long, joints 3–10 subcylindrical, about as long as broad, 2 slightly shorter than 3, 11 ovate, obliquely acuminate. Prothorax rather narrow, convex, rounded-subquadrate, densely punctate, without depression. Elytra moderately long, a little wider than the head, subparallel in their basal half, closely, coarsely punctate, the disc with a long, deep, oblique depression below the base. Legs stout; anterior and intermediate femora moderately, the posterior pair strongly, clavate; anterior tibiæ somewhat rounded externally, slightly sinuate within, and feebly mucronate at the apex; posterior tibiæ rather broad, flattened; basal joint of intermediate and posterior tarsi stout.

Length 2, breadth ⅘ mm.

Hab. CEYLON, Kandy.

One male, found by Mr. Bryant in June 1908. Very like the insect from Dikoya here identified as *X. testaceipennis*, ♂, but with the antennæ, the anterior femora and tibiæ, and elytra darker, the antennæ shorter and with much less elongate apical joint, the anterior tibiæ feebly sinuate within (instead of being abruptly bent), the elytra narrower, the legs stouter, and the tarsi shorter.

Xylophilus taprobanus, sp. n.

Moderately elongate, rather broad, shining; fusco-piceous, the elytra with a large, faint, indeterminate, humeral patch extending downwards along the sides, and an almost obsolete patch on the disc before the apex, the base and extreme tip of the antennæ, palpi, tarsi, anterior femora, and the base of the posterior tibiæ, testaceous or reddish; clothed with an extremely fine, adpressed, brownish-grey pubescence. Head convex, gradually narrowed behind the rather small eyes, densely, finely punctate; antennæ moderately long, slightly widened outwards, joint 3 smaller than 2, triangular, 4–10 long, subequal in length, subserrate, 11 stout, obliquely acuminate. Prothorax subquadrate, sinuate at the base, obliquely narrowed in front, densely, finely punctate, the disc with shallow arcuate depression behind. Elytra moderately long, nearly twice as wide as the prothorax, subparallel to about the middle, closely, somewhat coarsely punctate, transversely depressed below the base. Legs long, the posterior femora moderately thickened, simple.

Length 2 mm. (♂?).

Hab. CEYLON, Bogawantalawa, between 4900 and 5200 ft. (*G. Lewis*).

One specimen, found March 8th, 1882. Less elongate than *X. planipennis*, the antennæ with joint 3 very small, 4–10 long, subequal, and 11 thickened, the elytra much shorter, more coarsely punctate, and transversely depressed below the base. Larger, more robust, and with much longer limbs than *X. subcrassicornis*, Pic, from Kandy, which also has a minute third antennal joint. *X. rufipes*, Motsch., from Nuwara Elia, may be an allied form (?); it is described as nigro-fuscous, with the antennæ and legs rufo-testaceous, the elytra fusco-testaceous, the length ⅔ lin. The type of *X. taprobanus* is probably a male, to judge from the length of the antennæ, but the anterior tibiæ and posterior femora are simple.

Xylophilus scoparius, sp. n.

Elongate, shining; testaceous, the head, the elytral suture very narrowly, the under surface, the posterior femora (except at the base), and in one specimen the apices of the intermediate femora also, black or piceous, the prothorax reddish; clothed with rather long, pallid pubescence. Head transverse, densely, finely punctate, narrowly extended on each side behind the very large eyes; antennæ short, rather slender, slightly widened outwards, joints 3–10 subequal in length, 11 stout, obliquely acuminate. Prothorax rounded-subquadrate, narrower than the head, densely, finely punctate, without definite depression on the disc. Elytra long, subparallel, flattened, much wider than the head, obliquely depressed below the base, closely, rather coarsely punctate. Legs long, slender; posterior femora clavate; posterior tibiæ flattened, and becoming gradually wider and curving outwards towards the tip, obliquely truncated at the apex externally and there furnished with a brush-like cluster of hairs.

Length $2\frac{1}{10}$–$2\frac{1}{4}$ mm. (♂?).

Hab. CEYLON, Dikoya, between 3800 and 4200 ft. (*G. Lewis*).

Two examples, found in Dec. 1881. They are no doubt males, but the anterior tibiæ and tarsi are simple, and the antennæ comparatively short. The brush of hairs at the outer apical angle of the posterior tibiæ is a peculiar character. The insect cannot be the *X. testaceipennis* of Motschulsky.

Xylophilus cribricollis.

Hylophilus cribricollis, Pic, Bull. Soc. Ent. Fr., Jan. 1912, p. 48; Ann. Soc. Ent. Fr. 1912, p. 280 (April, 1913).
Hylophilus mucronatus, Pic, Ann. Soc. Fr. 1912, pp. 275, 280.

♂. Anterior tibiæ abruptly bent inwards at about the apical third and strongly mucronate at the inner apical angle.

Hab. CEYLON, Kandy. [W. Australia *, ? in error.]

The unique types of these insects, ♂ ♂, are absolutely identical, and some mistake must evidently have been made in attaching the locality-labels to one of them. Mr. Bryant believes that Ceylon is probably correct. These specimens have the head piceous, the antennæ fusco-testaceous, the prothorax rufescent, and the elytra and legs (the partly infuscate posterior femora and tibiæ excepted) testaceous; the antennal joints 3–10 rather stout and subequal in length, and 11 (wanting in *H. mucronatus*) as long as 9 and 10 united and strongly acuminate; the posterior femora strongly clavate and simple; the posterior tibiæ flattened and somewhat dilated; and the basal joint of the posterior tarsi slightly curved.

Xylophilus nigronotatus.

Hylophilus nigronotatus, Pic, Ann. Soc. Ent. Fr. 1912, pp. 276, 280 (excl. var.).

♂. Anterior tibiæ curved; posterior femora strongly clavate, armed with a sharp tooth near the apex and set with a row of short, scattered, bristly hairs along their lower face.

Hab. CEYLON, Kandy.

The above-mentioned characters are taken from the unique male, which is stated to have a "lamella beneath the posterior femora," the lamella in question being a clot of gum hiding the true armature. The insect is testaceous, with a triangular scutellar patch and a narrow common median fascia piceous. The antennæ are rather long and stout, joints 3–10 subequal in length, and 11 about as long as 9 and 10 united. The female of the so-called var. *diversiceps* belongs to a different species.

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* *H. major*, Pic [♂], from Illawarra, N.S.W. = *X.* (*Anthicus*) *abnormis*, King [♂], a specimen of which was given me long ago by Mr. A. M. Lea

Xylophilus nigropictus, sp. n.

♂. Moderately elongate, narrow, rather convex, shining; testaceous, the eyes black, the head, antennæ, and posterior femora and tibiæ slightly infuscate, the elytra with the suture very narrowly and a rather large spot on the disc beyond the middle nigro-piceous; clothed with rather long, fine, pallid pubescence. Head transverse, broader than the prothorax, densely, finely punctate, narrowly extended on each side behind the eyes, the latter somewhat narrowly separated; antennæ moderately long, subfiliform, not very slender, joints 3–10 subequal in length, subcylindrical, 11 rather stout, obliquely acuminate. Prothorax transverse, parallel-sided at the base, densely, finely punctate, with a shallow, interrupted, arcuate depression on the disc behind. Elytra moderately long, subparallel to about the middle, much wider, and a little more coarsely punctured, than the prothorax, the disc obliquely depressed anteriorly. Legs long; anterior tibiæ feebly sinuate within; intermediate tibiæ bowed, strongly bisinuate within; posterior femora clavate, with a narrow, pallid, pad along their lower face, bearing a row of short, scattered, bristly hairs, and armed with a short tooth before the tip.

Length 2 mm.

Hab. CEYLON, Dikoya (*G. Lewis*).

One specimen, captured on Dec. 12th, 1881. Very near *X. nigronotatus*, Pic, from Kandy; but more elongate and with longer limbs, the elytra not so coarsely punctate and each with a spot on the disc (instead of being fasciate), the intermediate tibiæ bowed and strongly bisinuate within in ♂, the posterior femora in the same sex similarly armed, but with a conspicuous, narrow, pallid pad along their lower face.

Xylophilus ceylonicus.

Hylophilus ceylonicus, Pic, Ann. Soc Ent. Fr. 1912, pp. 275, 280.

♂. Anterior tibiæ widened and somewhat curved outwards, and armed with a long, abruptly bent, inwardly-directed spur at the outer apical angle beneath ; posterior tibiæ flattened and rather broad.

Hab. CEYLON, Kandy.

The ♂ and ♀ labelled as co-types of *X. ceylonicus* in Mr. Bryant's collection somewhat doubtfully belong to the same species, the ♀ having smaller and less coarsely facetted eyes, shorter and more slender antennæ, and less coarsely punctured elytra, than the ♂. The antennal joints 3–10, however, are subequal in length and the posterior femora strongly clavate in both of them. The long, abruptly bent spur at the apex of the front tibiæ of the ♂ was not noticed in Pic's description. There is a similar ♀ in the British Museum, found by Thwaites in Ceylon.

Xylophilus dikoyanus, sp. n.

Short, opaque, the elytra slightly shining ; testaceous, the head and posterior femora piceous, the eyes black ; the elytra with a spot on the disc below the base, a common, angulate, subapical fascia, and an indication of an angular patch at the sides, fuscous ; the upper surface densely, finely, the elytra a little more diffusely, punctate, the prothorax and elytra variegated with extremely fine, close, adpressed, flavo-cinereous and brown pubescence, the vestiture of the head uniformly cinereous. Head very broad, the eyes in ♂ extremely large and occupying the whole of the side of the head, very little smaller in ♀, distant in both sexes ; antennæ slender, slightly widened outwards, long in ♂, much shorter in ♀, joint 2 very short, 3 twice as long as 2 and a little longer than 4, 11 acuminate-ovate. Prothorax small, broader than long, the disc transversely impressed before the base. Elytra about twice as wide as the prothorax, short, parallel at the base, the post-basal depression conspicuous. Legs slender, the posterior femora moderately incrassate, simple in ♂, the anterior tibiæ in this sex armed with a small tooth on the inner edge at a little beyond the middle.

Length 1⅗–2 mm. (♂ ♀).

Hab. CEYLON, Dikoya, between 3800 and 4200 ft. (*G. Lewis*).

One male (in very fresh condition) and two females. This species bears some resemblance to the European *X. populneus*, except that the antennæ and posterior femora are not nearly so stout. The long third joint of the antennæ separates it from *X. orientalis*.

Xylophilus orientalis, sp. n.

Short, opaque, the elytra shining (when denuded) ; testaceous, the elytra with three faint, angulate, interrupted, transverse, darker fasciæ, which are sometimes indistinct or obsolete, the eyes black, the posterior femora slightly infuscate towards the apex; the upper surface densely, minutely, the elytra a little more coarsely, punctate, very finely pubescent. Head short, broad, the eyes very large, separated by about the width of one of them and occupying nearly the whole of the side of the head; antennæ slender, slightly widened outwards, moderately long, joint 3 small, about half the length of 4, 4–10 subequal in length, 11 acuminate-ovate. Prothorax transversely-subquadrate, obliquely narrowed in front, the disc with a transverse impression before the base. Elytra short, about twice as wide as the prothorax, subparallel in their basal half, the post-basal depression transverse and rather deep. Legs slender, the anterior tibiæ in ♂ angularly dilated towards the apex within, the posterior femora moderately incrassate, simple.

Length $1\frac{4}{5}$–2 mm. (♂ ♀).

Hab. INDIA, Calcutta (*ex coll. Pascoe*) [type]; CEYLON (*Thwaites, in Mus. Brit.*).

One male from Calcutta, three females from Ceylon, almost certainly belonging to the same species. Extremely like *X. dikoyanus*, but with a small third joint to the antennæ and the eyes not quite so large; the elytra in the ♂ type distinctly trifasciate (the second fascia placed just beyond the middle); the antennæ of ♂ much shorter, and the armature of the anterior tibiæ different in this sex. *X. rufinus*, Fairm., from Belgaum, must be an allied form: a co-type of the supposed ♀ (which is really a ♂ with a minute tooth on the anterior tibiæ), lent me by Mr. Andrewes, is very like *X. orientalis*, but it has smaller eyes, stouter antennæ, and shorter unicolorous elytra. *X. rufotestaceus*, Pic, from Malabar, is unrecognizable from description. The Thwaites specimens were received by the Museum in 1867.

Xylophilus diversiceps.

Hylophilus nigronotatus, var. *diversiceps*, Pic, Ann. Soc. Ent. Fr. 1912, pp. 276, 280.

Hab. CEYLON, Kandy.

The type of this form is almost certainly a ♀, and the differences between it and *X. nigronotatus*, ♂, show that they cannot be the sexual complements of the same species: the prothorax is more transverse, being nearly as wide as the head; the elytra are much broader; the antennæ are comparatively short and slender; the legs are shorter; and the posterior femora are but little thickened. The insect is testaceous, with the head, and a large triangular scutellar patch on the elytra, connected along the suture with a broad median fascia, nigro-piceous.

Xylophilus bryanti.

Hylophilus bryanti, Pic, Ann. Soc. Ent. Fr. 1912, pp. 277, 280.

Hab. CEYLON, Kandy.

There are five examples of this species in Mr. Bryant's collection, two of which may be males: they have the posterior legs stouter and the antennæ a little longer than in the others. A small, robust form, black, with a large transverse humeral patch on the elytra, and the apex, rufescent, the antennæ (the base excepted), palpi, anterior legs in great part, and the intermediate and posterior tarsi, testaceous, the posterior femora strongly clavate, the antennal joints 3–10 subequal in length.

Xylophilus concolor, sp. n.

♀. Rather broad, short, shining, rufo-testaceous, the eyes black, the legs testaceous; clothed with fine yellowish pubescence; the head and prothorax densely, finely, the elytra more coarsely, punctate. Head broad, short, very narrowly extended behind the eyes, the latter large and well separated; antennæ moderately long, stout, joints 3–7 about as long as broad, 8–10 transverse, 2 a little shorter than 3, 11 ovate. Prothorax strongly transverse, as wide as the post-ocular portion of the head, the sides subparallel at the base. Elytra rather convex, broad, parallel at the base, unimpressed on the disc. Legs moderately long; posterior femora comparatively slender, very little stouter than the intermediate pair.

Length 1⅔ mm.

Hab. CEYLON, Kandy.

One specimen, ♀, captured by Mr. Bryant in June, 1908. This insect was found placed in his collection under *X. ceylonicus*, Pic, from the ♀ of which it differs in its broader prothorax, shorter, more densely punctate elytra, more approximate eyes, and slender posterior femora.

Xylophilus subcrassicornis.

Hylophilus subcrassicornis, Pic, Ann. Soc. Ent. Fr. 1912, pp. 278, 280.

♂. Anterior tarsi thickened; antennæ much more elongate than in ♀, joints 4–10 longer than broad.

Hab. CEYLON, Kandy.

Three specimens of this species are before me—one male and two females, one of the latter darker than the other. Less robust than *X. bryanti*; the base of the elytra broadly, and sometimes the disc also towards the apex, obscurely testaceous or rufescent; the antennæ black, except at the base and tip, much shorter in ♀ than in ♂, joints 2 and 3 small in both sexes; the head long; the eyes smaller; the posterior femora much less thickened. The sexual characters were not noticed by Pic.

Xylophilus laticornis.

Hylophilus laticornis, Pic, Ann. Soc. Ent. Fr. 1912, pp. 278, 280.

Hab. CEYLON, Kandy [type]; TENASSERIM, Mergui (*Doherty*).

The three specimens of *X. laticornis* in Mr. Bryant's collection are almost certainly females, and there is an example from Mergui in the British Museum exactly agreeing with them. In this insect the head is much prolonged behind the eyes, the eyes are small, and the elytra are short, broad, convex, and somewhat coarsely, densely punctate, and rather variable in colour, according to the predominance of the testaceous or blackish markings.

XXVIII.—*On the Species of* Lucifer *and their Distribution.*

By L. A. BORRADAILE, M.A., Lecturer in Zoology in the University of Cambridge; Fellow, Dean, and Lecturer of Selwyn College.

OUR knowledge of the species of *Lucifer* is at present in a confusion which is regrettable, not only from the point of view of the systematist but also because it prevents the drawing of conclusions as to the distribution of a characteristic constituent of the pelagic fauna. The difficulties of the subject are due to the very insufficient descriptions given by Milne-Edwards, who named the first two species, the genus having been founded by Vaughan Thompson for an unnamed form. Milne-Edwards's obscurity has led subsequent writers to confound under each of his names quite distinct species. It seems probable, indeed, from an examination of the descriptions and drawings given by various authors, that the species of *Lucifer* are far more numerous than has hitherto been suspected. The only alternative to this conclusion is to attribute to authorities who are usually quite trustworthy an extraordinarily high proportion of error in their diagnoses and figures. This I am the less inclined to do as I have been able in some cases to confirm the accuracy of the published descriptions by the examination of specimens, and as it is, in any case, wiser to emphasize than to ignore possible differences. The most valuable contributions to the subject have been made by Dana and by Kemp, and I have in the main accepted their decisions in the following synonymic list:—

1. *Lucifer typus*, H. M.-Edw., 1837.

Lucifer, J. V. Thompson, Zool. Researches, iv. p. 58, pl. vii. fig. 2 (1829).
Leucifer typus, H. Milne-Edwards, Hist. Nat. Crust. ii. p. 469 (1837).

Kemp thinks that this species is probably identical with the *L. acestra* of Dana. The two are undoubtedly related, but there are marked differences between Thompson's figure and Dana's in respect of the sixth abdominal segment and its limb. It seems best at present to maintain the specific distinctness of *L. typus* until further research has rendered it unlikely that there exists a species which corresponds with Thompson's figure. In any case, the identification cannot be sufficiently certain to justify the supersession of Dana's name.

Tropical N. Atlantic.

2. *Lucifer reynaudi*, H. M.-Edw., 1837.

Leucifer reynaudii, H. Milne-Edwards, Hist. Nat. Crust. ii. p. 469, pl. xxvi. fig. 10 (1837).
Lucifer reynaudi, Dana, U.S. Expl. Exped., Crust. i. p. 672 (1852); Atlas, pl. xlv. fig. 1 (1855).
Lucifer reynaudii, Kemp, Trans. Linn. Soc. Lond., Zool. (2) xvi. 1, p. 58 (1913).

Indian Ocean. Sooloo Sea.

3. *Lucifer acestra*, Dana, 1852.

Lucifer acestra, Dana, U.S. Expl. Exped., Crust. i. p. 671 (1852); Atlas, pl. xliv. fig. 9 (1855); Streets, Bull. U.S. Mus. vii. p. 122 (1877); Faxon, Mem. Mus. Harvard, xviii. p. 214 (1895); Kemp, Trans. Linn. Soc. Lond., Zool. (2) xvi. 1, p. 58 (1913).

Throughout the warmer parts of the Pacific and Indian Oceans from Mexico to Mauritius.

4. *Lucifer pacificus*, Dana, 1852.

Lucifer pacificus, Dana, U.S. Expl. Exped., Crust. i. p. 673 (1852); Atlas, pl. xlv. fig. 2 (1855).

Tropical Pacific.

5. *Lucifer acicularis*, Dana, 1852.

Lucifer acicularis, Dana, U.S. Expl. Exped., Crust. i. p. 674 (1852); Atlas, pl. xlv. fig. 3 (1855).

Harbour of Rio Janeiro.

6. *Lucifer bonitensis*, sp. n.

Lucifer typus, Eydoux & Souleyet, Voy. de la 'Bonite,' Zool. i. p. 249, pl. iv. figs. 1–12 (1841).

Habitat ?

7. *Lucifer clausi*, sp. n.

Lucifer typus ?, Claus, Zeit. f. wiss. Zool. xiii. p. 435, pl. xxviii. figs. 21–26 (1863).
Lucifer typus, Carus, Prodr. Faun. Medit. i. p. 470 (1885).

This species is closely related to *L. batei* (= *L. reynaudii*, Bate), but differs in the shorter neck and longer sixth abdominal segment, and also, probably, in the petasma. Carus's definition of it seems to be derived from a misreading of Milne-Edwards's diagnosis of *L. typus.*

Messina.

8. *Lucifer faxoni*, sp. n.

Lucifer typus ?, Faxon, Stud. Biol. Lab. Joh. Hopkins Univ. 3, p. 113, pl. vii. (1878).
Lucifer sp., Brooks, Phil. Trans. Roy. Soc. 1882, i. p. 87, pl. vii.
? *Lucifer*, sp. n. ?, Semper, Zeit. f. wiss. Zool. xxii. p. 305, pl. xxii. (1872).

In Semper's figure of the end of the abdomen of the male, the tip of the exopodite of the uropod is either incorrectly drawn or indicates that the individual from which it was taken represents a species different from any hitherto described. The female seems to differ in no important respect from *L. faxoni*, but, in view of the locality in which Semper's specimens were taken, it is at least doubtful whether they belong to Faxon's species.

N.W. Atlantic. E. Subtropical Atlantic (Brit. Antarc. Exped.). ? Near Philippine Is.

9. *Lucifer affinis*, sp. n.

Lucifer typus, Bate, 'Challenger' Report, Zool. xxiv. p. 464, pl. lxxxiii. (1888); Ortmann, Ergebn. Plankton-Exp. ii. G, *b*, p. 40 (1893); Nobili, Mem. Ac. Torino, (2) lvii. p. 352, pl. i. fig. 1 (1903).

Various localities in the Tropical and Subtropical Atlantic, Pacific, and Indian Oceans, generally near land.

10. *Lucifer batei*, sp. n.

Lucifer reynaudii, Bate, 'Challenger' Report, Zool. xxiv. p. 466, pl. lxxxiv. (1888); Ortmann, Ergebn. Plankton-Exp. ii. G, *b*, p. 40 (1893).
? *Lucifer reynaudi*, Dohrn. Zeit. f. wiss. Zool. xxi. p. 357, pl. xxvii. figs. 1–10 (1871).

In Dohrn's figure the legs are considerably longer than in Bate's, with which specimens in my hands agree. Dohrn, however, is certainly wrong in his representation of the antennules, and may be also inaccurate in regard to the legs.

This species is related to Dana's *acestra*, but differs from it in the following respects:—(i.) the rostrum is present; (ii.) the legs of the last two pairs are longer; (iii.) the dorsal spine of the sixth abdominal segment is terminal and projecting, not subterminal; (iv.) the exopodite of the uropod is blunt-ended, with the terminal spine at one side, instead of diminishing gradually into the spine; (v.) the ventral tubercle of the telson of the male is subrectangular, and directed very slightly forward.

Throughout the warmer parts of the Atlantic and Central Pacific, near land or on the high seas.

11. *Lucifer inermis*, sp. n.*

Diagnosis: A *Lucifer* with the neck about twice as long as the rest of the cephalothorax, the eye with stout stalk, rather more than one-third the length of the neck, the last leg just reaching the end of the neck, the preceding leg slightly shorter, the sixth abdominal segment rather shorter than the fourth and fifth together and rather longer than the uropod, the latter with pointed exopodite bearing very small spine removed from end, the telson about half the length of the uropod, and the hinder ventral spine of the sixth abdominal segment in the male stronger than the spine before it and sharp-pointed.

Melbourne Harbour (Brit. Antarc. Exped.).

Doubtful Species.

L. reynaudi, Dohrn, and the form recorded by Semper have been provisionally assigned in this list to *L. batei* and *L. faxoni* respectively, but it is quite possible that each of them represents a distinct species.

The characters by which the species of the foregoing list may be separated are shown in the following key:—

1. Neck shorter than rest of cephalothorax. Sixth abdominal segment more than half as long again as uropod. Telson and uropod subequal. [Eye-stalk stout. Legs short.] .... *L. acicularis*, Dana, 1852.

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* I am kindly permitted to include in the present paper a preliminary diagnosis of this species. It is founded on specimens in the 'Terra Nova' collection of Decapoda, which has been placed in my hands for examination.

II. Neck longer than rest of cephalothorax. Sixth abdominal segment shorter or not much longer than uropod. Telson shorter than uropod.

A. Eye not more than half length of neck.

1. Eye-stalk stout. Hinder ventral spine of sixth abdominal segment of male sharp.

a. Exopodite of uropod more than five times as long as wide. Hinder ventral tooth of sixth abdominal segment of male followed by a pair of spinules .... *L. reynaudi*, H. M.-Edw., [1837.

b. Exopodite of uropod less than five times as long as wide. Hinder ventral tooth of sixth abdominal segment of male not followed by a pair of spinules.

i. Last leg does not reach end of neck. Eye less than one-third length of neck. [Spine on exopodite of uropod nearly or quite reaches end.] .... *L. affinis*, sp. n.

ii. Last leg reaches or exceeds end of neck. Eye rather more than one-third length of neck.

α. Spine on exopodite of uropod projects well beyond end, which is rounded. *L. faxoni*, sp. n.

β. Spine on exopodite of [illegible] does not nearly reac[illegible]r. Hinder ventral spine of *inermis*, sp. n.

2. Eye-[illegible] segment blunt .... *L. bon*[illegible]ixth

[illegible] Eye more than half length of neck. [illegible]*is*, sp. n.

1. Neck only slightly longer than rest of cephalothorax. Sixth abdominal segment longer than uropod.

a. Eye-stalk stout. Sixth abdominal segment longer than fourth and fifth together ... *L. pacificus*, Dana, [1852.

b. Eye-stalk slender. Sixth abdominal segment only as long as fourth and fifth together . *L. clausi*, sp. n.

2. Neck a good deal longer than rest of cephalothorax. Sixth abdominal segment not longer than uropod [or than fourth and fifth segments together].

a. Rostrum present. Last leg nearly or quite reaches end of neck. Exopodite of uropod blunt-ended, with terminal spine at end of outer side .... *L. batei*, sp. n.

b. Rostrum wanting. Last leg does not nearly reach end of neck. Exopodite of uropod diminishes to a point [where the spine stands, ? in *L. typus*].

i. Hinder ventral spine of sixth abdominal segment swollen at the end. Spine of exopodite of uropod well developed ...... *L. acestra*, Dana, 1852.

ii. Hinder ventral spine of sixth abdominal segment sharp-pointed. Spine of exopodite of uropod obsolete ? .... *L. typus*, H. M.-Edw., [1837.

If my conclusions as to the species of *Lucifer* be correct, it will appear that most of them have a distribution which, whether it be wide or restricted, is limited, and not worldwide. Two species alone seem at present to break this rule, *L. affinis* and *L. batei*, which are stated to occur both in the Atlantic and in the Pacific Oceans. It may be that differences will eventually be found between the eastern and western specimens which have been referred to these species. The genus is represented in all the warmer seas of the world, and in some of moderate warmth, but not, it would seem, in cold waters. There is some indication that certain species belong normally to coastal waters, others to the high seas, and yet others indifferently to both these kinds of habitat, but conclusions upon this question cannot safely be drawn until many more captures have been recorded. It will, of course, be necessary to distinguish between stray individuals and those which have been taken in their normal habitat.

XXIX.—*Note on the Nomenclature of certain Species of Ruteline Coleoptera.* By GILBERT J. ARROW.

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HAVING, with inexcusable carelessness, introduced as new several preoccupied names in the great genera *Anomala* and *Adoretus*, I here substitute fresh ones for them, and I have at the same time renamed various other species of the same genera whose present names are inadmissible for the same reason. The species are :—

Anomala peninsularis, Arrow, Ann. & Mag. Nat. Hist. (8) viii. 1911, p. 483 (preoccupied by Schaeffer, 1906), to be called . . . . *fulvohirta*, n. n.

A. phylloperthoides, Nonfr. Ent. Nachr. xx. 1894, p. 122 (preoccupied by Fairmaire, whose *Popillia phylloperthoides*, 1888, is an *Anomala* closely related to *A. erythroptera*, Kraatz), to be called . . . . . *alterata*, n. n.

A. mimeloides, Reitt. Verh. Ver. Brünn. xli. 1903, p. 71 (preoccupied by Ohaus, 1902), to be called . . . *sinica*, n. n.

A. whiteheadi, Ohaus, Philipp. Journ. Sci. v. 1910 (October), p. 243 (preoccupied by Arrow, July 1910), to be called . . . . *albaya*, n. n.

Adoretus ampliatus, Fairm. Ann. Soc. Ent. Belg. xlix. 1905, p. 120 (quite different from *A. ampliatus*, Fairm. Ann. Soc. Ent. Belg. xlviii. 1904, p. 226), to be called	*major*, n. n.
Ad. flavovittatus, Arrow, Trans. Zool. Soc. xix. 1909, p. 190 (preoccupied by Nonfried, 1892), to be called . .	*tigrinus*, n. n.
Ad. parallelus, Arrow, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 598 (preoccupied by Kraatz, 1895), to be called	*lemniscus*, n. n.
Ad. parallelus, Linell, Proc. U.S. Mus. xviii. (1895), Aug. 1896, p. 692, to be called	*tananus*, n. n.
Ad. setifer, Brenske, Soc. Ent. viii. 1893, p. 9 (preoccupied by Reitter, 1889), to be called	*xanthomerus*, n. n.
Ad. simplex, Péring. Trans. S. Afr. Phil. Soc. xii. 1902, p. 579 (preoccupied by Sharp, 1878), to be called . .	*truncatus*, n. n.
Ad. uniformis, Arrow, Ann. & Mag. Nat. Hist. (7) ix. 1902, p. 91 (preoccupied by Fairmaire, 1887), to be called .	*lepus*, n. n.

BIBLIOGRAPHICAL NOTICE.

An Index to the Museum Boltenianum.

When, in 1906, C. Davies Sherborn and E. R. Sykes brought out the photographic facsimile of the scarce 1798, or first, edition of the 'Museum Boltenianum,' pt. ii., they were only able to add as an afterthought an 'Index to the Genera.'

The supreme importance of the work to the systematic conchologist had, of course, already been known; but Dr. W. H. Dall, who went thoroughly into the question, showed a little later (Journ. of Conch. xi. 1906, pp. 294–297) that some forty generic names were certainly, and about thirty more probably, affected by it.

The veteran American malacologist has now conferred a great boon on his fellow-students by compiling a complete Index of all the names, which has just been published by the Smithsonian Institution (Publication 2360, 1915, pp. 64, 8vo).

To this is prefixed a translation of Lichtenstein's Latin preface, in which, quaintly enough, the translator has retained the Latin form "Boltenius" for the name of the owner of the collection catalogued. Translations are also given of the German Introduction to the first edition by Röding and of that to the second edition (1819) by Noodt.

B. B. W.

THE ANNALS

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XXX.—*Observations on the Cape* Cephalodiscus (C. gilchristi, *Ridewood*) *and some of its Early Stages.* By J. D. F. GILCHRIST, M.A., Ph.D., D.Sc. *With an Appendix by* SIDNEY F. HARMER, Sc.D., F.R.S.

[Plate XI.]

DURING the course of the marine biological survey undertaken by the Cape Government, a species of *Cephalodiscus* was found at various localities on the South-African coast, but most abundantly on an area of mud on the south coast. The primary object of the survey being a practical one, this area, which proved to be extensive and of great commercial value, was thoroughly examined and tested by means of the trawl; numerous specimens of *Cephalodiscus* were therefore readily procured, and these were forwarded to the British Museum, where they were examined and reported on by Ridewood (4), who described them as *C. gilchristi.* As the object of the survey was attained and private trawlers from Europe began to develop the new fishing-ground, the exploring work of the Government trawler was suspended. It is still possible, however, to procure specimens, though not so readily as before, and I am indebted to Mr. Wadner, the manager of one of the trawling companies, for the facilities which he has put at my disposal for procuring additional material, on which the following observations are based. The object of this re-examination was to gain some knowledge of the living animal, and more especially of its eggs and larvæ.

The procuring of specimens by the trawler in the course of its fishing operations was found to be a matter of great uncertainty; sometimes a week or more would pass without any trace of them, at other times only imperfect samples or fragments were found, and most were much damaged, apparently by being dragged about amongst the fish in the trawl-net. Some good samples were, however, unexpectedly procured, having probably passed into the trawl just before heaving. It was noteworthy that all were large, or pieces of large colonies, and sometimes showed a broad base by which they had obviously been attached to the rocks or substratum on which they grew. It was evident also that in most cases they had been detached for some considerable time before capture, and had lain on the muddy bottom of the sea for a time, as their base of attachment was abraded and sometimes covered with an incrustation of animal or vegetable growth. This condition was also frequently observed on the branches of one side, which doubtless had been resting on the sea-bottom. Two or three well-developed specimens, with thick branches and short spines, were not only completely devoid of zooids, but were covered with numerous kinds of other animals. In two cases many of the tubes of the zooids were occupied by small anemones, and on the surface small crustacea, polychætes, nemerteans, &c., were abundant; the cœnœcium was of a dark dirty colour, in contrast with the clear brown substance of the younger specimens, characterized by their narrower branches and long spines.

Habitat.

That the natural habitat of the animals is not the area of mud or mud and sand on which they are captured is indicated by the abraded base and sides of the specimens, and it would appear that they normally occur on rocky ground closer inshore, those procured by the trawl having been carried by currents, which are often strong in this region, on to the muddy ground. Fish, including soles, are very abundant on this ground, and the same spots are trawled over again and again. On some of these it has been observed that the same course may be passed over repeatedly without any trace of *Cephalodiscus*, when suddenly several specimens may be found, indicating that they have been carried there by currents. It may be possible to find specimens at extreme low tide on this rocky ground, which lies between the mud area and the shore, but no indications of these have as yet been found in this locality, nor have any fragments of the cœnœcium been observed cast up on the shore. The oyster-gatherers of the locality are familiar with the general appearance of most fairly large objects at extreme low tide, but none of them, with one doubtful exception, recognized a specimen shown them as having been met with in the course of their work. It may therefore be concluded that the Cape *Cephalodiscus* grows in fairly deep water on rocky ground.

Mode of Occurrence.

The mode of occurrence of the animals on the rocky areas, which they seem to frequent, is indicated by some interesting specimens procured. Those which showed a region of attachment had a basis of irregular shape, about 2 inches or so in diameter, on which the bush-like structure of the cœnœcium was supported. This appearance is so characteristic of the Cape species that the fishermen call them "sea bushes." Other specimens, however, showed an expanded sheet of cœnœcial substance devoid of animals, and on this several such "bushes" occurred. It would appear, therefore, that the rock or substratum may be covered by more or less extensive sheets of cœnœcial substance from which the branching stems may arise.

It may be noted that the condition of the basal part of these specimens with a single point of attachment is not incompatible with the supposition that they may have come from a more extended base.

One specimen * was of particular interest, as it retained the object on which it had grown and is the only case, so far as I know, in which the basal object has been found, except those described by Harmer (2) in the 'Siboga' Expedition collection. This object was a comparatively small piece of sponge about 4 inches in length and of a compact hard skeletal structure. The history of this has been probably that a larva or larvæ which, as I have noticed, have a tendency to crawl upwards, had begun their cœnœcium-building on the sponge or its dead skeleton, and this was gradually built up to a comparatively large superstructure.

That the animals occur in fair abundance in their natural habitat is indicated by the frequency with which detached specimens are found at a distance from rocky ground.

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* [This specimen has been presented by Dr. Gilchrist to the British Museum. Mr. R. Kirkpatrick informs me that the Sponge referred to belongs to the genus *Chondrocladia*, Wyv. Thoms., and the family Desmacidonidæ.—S. F. H.]

Habits of the Zooids and Buds.

Some opportunity was offered of studying the habits and behaviour of the zooids and buds in the living condition, though much of the material, when brought on board, showed few living animals, and these were more or less in a moribund condition, many having dropped to the bottom of the vessel in which they were placed. Occasionally, however, a specimen was got—probably taken just before the trawl was hauled—covered with living animals. The appearance presented in such cases was very striking, and is probably characteristic of the normal state of the animal. The zooids and buds were on the surface of the cœnœcium, and imparted to some of the more crowded branches quite a black appearance. When examined more closely, with the aid of a lens, the general aspect was that of a mass of small black threads with swollen extremities, or a number of small black pins scattered indiscriminately over the surface of the cœnœcium. These were the stalks and expanded proboscides of the buds. Some of these stalks were about 4 or 5 mm. in length, and ended in a large sucker-like proboscis, which was firmly adherent to the surface of the cœnœcium, at some distance from the zooid to which it belonged. The zooid itself was found at the entrance of the tube, on the spine, or even at some distance from the tube. The general appearance suggested that the buds were acting as anchoring individuals for the fully developed zooid. No movement was observed in buds or adult zooids, with the exception of an occasional spasmodic jerking of the arms, the significance of which will be discussed later. When the attached proboscis of the bud was gently touched by a needle it at first showed no signs of reaction, except a slight withdrawing movement; but, on the irritation being continued, it suddenly relaxed its hold on the surface of the cœnœcium, and was withdrawn rather rapidly towards its point of attachment to the zooid by a spiral coiling of the stalk, the proboscis preceding or being closely applied to the stalk, as they both disappeared into the cœnœcial cavity. This movement was apparently the result of a contraction of the muscles of the stalk, but in one or two cases it was observed to be continued as an active crawling movement, which was seen under the microscope to be due to the action of the ciliated surface, to be noted more fully below. In the withdrawal of the proboscis from the surface a quantity of viscid mucus-like substance was observed at the point of attachment, and if this substance touched the needle it adhered to it somewhat tenaciously.

The zooid itself was more easily detached, and many were seen secured only by the buds; on one or two occasions, indeed, the whole cluster of buds and zooid was observed suspended in mid-water by the much drawn out and attenuated stalk of a bud, which was securely attached to the cœnœcium by its sucker-like proboscis. The point of weakness was apparently the proximal end of the stalk of the bud, for after a time some of the large buds were seen to break at this point, and ultimately many isolated buds were found scattered over the general surface. Isolated buds were also seen on some of the rather damaged specimens, and these had probably been separated from their zooids by the rough usage and movement of the surrounding water in the process of capture. Sometimes the rupture of the stalk was near the proboscis, and isolated proboscides were occasionally seen. No isolated buds were seen which could not be accounted for in this way.

In some of the specimens examined, the zooids with their buds were withdrawn from their tubes with the aid of a pair of forceps, and there appeared to be more zooids than one in such groups. Previous observers have seen only one zooid in one tube in the section of the genus to which this species belongs, and so constant has been this observation that the name "*Idiothecia*" (3) has been proposed for this section, which is characterized by the fact, which the name implies, that only one individual zooid inhabits a tube. I therefore supposed that, in removing the group from its tube, I had taken a number of free zooids which had become entwined with each other at the mouth of a tube, as often happened amongst loose individuals in the material procured. A more careful examination, however, of some of the preserved material, in which zooids and buds are often found withdrawn into their tubes, confirmed the original observation. Here, in several cases, three or four zooids were found projecting from the aperture of one tube, part of their visceral region and all the buds being contained within the tube. These were sexually mature, with well-developed gonads, and, as far as could be made out, were quite independent of each other, though where they were embedded in the tube the buds were more or less interwoven, forming a solid mass, which was difficult to disentangle without making sure that no connection was broken.

Cilia, Mode of Feeding, etc.

When examined under the microscope the living animals are seen to be provided with short cilia, occurring, so far as could be observed, on all parts of the body and stalk, both of zooids and buds. These cilia, except on the arms, are rather fine, and in some places could be seen with difficulty with a Zeiss C lens; but the energetic movement of the surrounding water which they brought about was very apparent in the small particles of various kinds of matter which they caused to move rapidly over the surface. The direction of such movement, both in zooid and bud, was from the attached towards the free end. Thus, in the case of the zooid, particles were seen to move rapidly up the stalk and over the visceral region of the body towards the arms. The details of their further progress could best be seen in a detached arm. In this an active stream of particles was seen passing rapidly over the tentacles on each side of the arm towards its distal extremity; most of these were discharged into the water, but now and again a particle was observed to pass along the central groove of the arm in the opposite direction towards the mouth. This groove, which is broad and shallow, was seen to be provided with stronger and longer cilia than occurred elsewhere. Cilia on the tentacles were much smaller even than those on the body, and could with difficulty be made out, and, but for the active movement of particles near them, their existence might have been doubted. The active jerking movement already noted was apparently mainly in the tentacles, and seems to be associated with the feeding process—perhaps the selection of particles fit for food to be returned to the mouth by the groove in the arms. It is of interest to compare this method of feeding with what I have described elsewhere (1) for *Phoronis*. Here the body is enclosed in a tube, which the animal never leaves, and it is not ciliated. Food and other particles are brought in a current of water, which passes inwards between the outer and inner circle of tentacles, and flows outwards between the tentacles. Some of these particles are in some way selected, and are passed down into the food-groove running round the inner base of the tentacles towards the mouth. This food-groove may be enlarged by a low web of tissue connecting the tentacles slightly at their bases, and it is at once suggested that the arms of *Cephalodiscus* are outgrowths or extensions of such a food-groove, while the tentacle on each side of the arms may be compared to those of *Phoronis*, which exhibit the characteristic jerking movement—a sudden flexing inward from the tip,—perhaps in connection with the selection of the food-particles out of the many passing over them. The absence of arms and tentacles in the collar-region of *Balanoglossus* is associated with the more indiscriminative manner in which it procures its food. The manner in which

Cephalodiscus thus procures its food-supply entails, of course, a much freer mode of life than in the strictly tubicolous *Phoronis*, but the present observation seems to show that this is the actual case, and that the zooids are freely exposed to the surrounding water and may even attain a freer exposure by climbing up the spine, the function of which is thus indicated.

The bud and zooids were secured to the cœnœcium by their proboscides, which apparently secreted the mucus-like substance seen on detaching them. There was no evidence that there was any such secretion by the arms. The cœnœcium-building would therefore appear to be due to the proboscides, though sufficient evidence of this will probably only be secured when active and healthy zooids are observed in the building process.

Pigmentation.

When alive the zooids and buds were of a black colour, which under the microscope appeared a very dark brown. The whole of the proboscis, collar, and body was of this colour, with a somewhat darker shade on the upper region of the proboscis furthest from the red line, which was observed to be as characteristic a feature of living as of preserved specimens. The dark colour extended on to the stalk or stolon, but here at a few places it was absent or represented by somewhat scattered dark brown pigment-spots. The position and extent of these less-coloured parts varied in different individuals. The appearance of the arms and tentacles was totally different, and stood out in strong contrast to that of the body; they were of a conspicuous white colour, often tinged with a faint yellow. The black colour rapidly dissolved out when the animal was put into the preserving fluid, which then assumed a brown appearance. In some cases the fluid was renewed daily three times before remaining clear. If left without renewal the fluid gradually cleared, the colour being redeposited in the animal and cœnœcium.

Further observations on the living animals were not possible, owing to the fact that they died off so quickly. Probably with a good supply of sea-water at the proper temperature it may yet be possible to gather much more information, and even to keep the animals under observation in an aquarium.

Eggs, Embryos, and Larvæ.

By unexpected good fortune the very first specimen procured was sufficient to demonstrate the general appearance of advanced embryos and larvæ—a good fortune which, however, as unexpectedly was not continued. The animals in this case were dead, but by cutting longitudinal and transverse sections of the branches numbers of embryos in an advanced stage were seen, and one of these was actually hatched out when being observed under the microscope. This embryo was seen rotating actively within the egg-capsule, and was so large that it was bent on itself, one end slightly overlapping the other. The egg-capsule was ruptured, and the embryo escaped, assuming the form of an elongate ovoid larva, which progressed actively over the bottom of the containing glass by means of its ciliated surface. Its shape and pigmentation were so characteristic that no difficulty could subsequently arise as to the determination of free larvæ about this stage. Numerous eggs, embryos, and a limited number of free larvæ were observed in specimens procured subsequently, but no such fully developed embryo in the egg as in this case. The identification of the larval form does not, however, depend on this one observation, as the characteristic pigment is assumed at a much earlier stage in the embryo; and free larvæ similar to the one observed were subsequently seen to come from branches of the cœnœcium under observation. It was found ultimately that the best way to secure free larvæ was to siphon off the deposit at the bottom of the vessel in which the specimen had been kept on board the trawler. On one occasion many such larvæ were found, but, as it chanced to be a very hot day, most of them died in a short time.

The eggs occur in the tube-like cavity inhabited by the animals, between which and the bottom of the tube there is usually a large space. One to six eggs occurred in this position. They were each enclosed in a pyriform egg-case, drawn out at its narrower end into a short tubular part, which ended abruptly in a somewhat flattened surface. This flattened end was adherent to the side of the cavity. Sometimes the egg-capsules were found adherent to various parts of the cavity, but frequently were closely set in groups, their bases being adherent to a somewhat restricted area. No early segmentation-stages were observed in the living egg, though subsequent examination of preserved material revealed several, from the two-celled stage onwards. Some of the earliest ciliated embryos were observed to be quite spherical in shape and to rotate rapidly on themselves by means of their cilia. Later stages were elongate and egg-shaped; one of these in the living condition measured ·55 mm. in length and ·24 mm. in greatest breadth. Numerous small pigment-spots were distributed over the surface in a uniform manner except at the broader end, where they were more crowded together, forming a dark ring round a white spot. This white spot corresponds in position to a clear spot seen in preserved larvæ, and was readily made out in some, but not all, living larvæ. It may represent an apical sense-organ. Such embryos rotated on their long axis, and continued to do so when set free from the egg-capsule. The embryo, partly folded on itself, noted above was evidently a later stage and of the form assumed just before the hatching. The larvæ (Pl. XI.) were procured from the bottom of the vessel containing the specimens, and only in one instance was a larva seen crawling on the cœnœcium. They vary somewhat in shape. Viewed from above they were ovoid in outline, usually somewhat narrower, but occasionally broad at the posterior end—that is, the end furthest removed from the direction of progression of the larva. The outline was usually regular, but not invariably so. At the posterior extremity there was observed a characteristic indentation or pit, apparently of a superficial nature, sometimes forming an acute angle in its centre, at other times appearing as a mere shallow depression, and in a few cases being apparently absent.

The size of the living larva was fairly uniform, measuring ·57 to ·59 mm. in length and about ·29 mm. in greatest breadth. It was difficult to secure a satisfactory side-view and exact measurements of the depth of the body, but, by tilting over the crawling larva, it was seen that it was not so flat as it appeared on a surface-view, the depth being about a fifth of its length.

The pigmentation of the larvæ was similar to that of the more advanced embryos, namely, numerous small dark brown dots, rounded, irregular, or elongate in shape, more crowded together at the anterior upper end. That the white spot seen in the embryo was not always visible may have been due to the fact that a large space or clear area now occurs in the anterior region of the body, the posterior third or so being occupied by a more opaque whitish mass, which proved in sections to be a mass of cells heavily laden with yolk. The anterior part of the larva appeared to be quite hollow. This was confirmed by sections, and was very obvious in specimens killed by acetic acid. In preserved specimens this anterior region usually collapsed.

The behaviour of the larvæ was similar in all cases observed, except that the rate of progression was more rapid in some. Movement was apparently effected by the action of the cilia, and was always in the direction of the long axis of the body, towards the thicker end. At no time were they seen to progress in mid-water; when dropped into the water they sank to the bottom and commenced crawling about. The rate of motion was often fairly rapid—an inch in seven seconds in one case—and the larva readily surmounted any obstacles in its path by crawling up and over them. They were slightly adherent to the substance over which they moved, so that the dish which contained them could be tilted under the microscope without altering the position of the larvæ by the movement of the water over them, except when this was continued for some time. Whether any mucus or adherent substance was secreted by the lower surface of the larva when in motion was not observed, but this seems not improbable, as sections reveal a thick foot-like area of epithelial cells on the anterior half. On one occasion a specimen picked up in a pipette became so firmly adherent to the glass that it was with difficulty removed, and it was observed to adhere most firmly by one end, the other moving freely with the passing of the water up and down the tube,

Summary of Results.

1. The normal habitat of *Cephalodiscus* in S. Africa appears to be rocky ground in fairly shallow water, but below low-water mark. It is either attached to rock or some substance growing on rock, but may become detached and carried on to muddy ground. It seems to be abundant on the south coast.
2. It may grow from a small basis, or the basis may be a broad sheet of cœnœcial substance from which several main stems arise.
3. In the living state the zooids and buds have been observed on the general surface of the cœnœcium outside the tube, and sometimes at a distance from it.
4. The buds in such cases act as anchors, being firmly adherent to the surface by their proboscides.
5. In both bud and zooid a quantity of viscid mucus occurs between the proboscis and the cœnœcium.
6. There is no evidence that the buds ever develop into normal zooids, and they may be individuals specialized for adhesive purposes and cœnœcium-building.
7. More than one zooid and its buds may occur in one tube in the cœnœcium in the Cape species.
8. Buds and zooids are provided with cilia over the whole of their surface. Their stolons or stalks are also ciliated.

9. The method of feeding is that particles are carried by means of these cilia to the arms, where a selection is made of the food-particles, which are returned to the mouth by the grooves in the arms.
10. The zooids and buds are black in the living condition, but the colour dissolves out very quickly in preservation.
11. The eggs are enclosed in a capsule, which is adherent by one end to the wall of the tube.
12. The embryo is ciliated and coloured at an early stage, the older embryos being folded on themselves. They rotate actively in the egg-capsule.
13. The free larva is elongate, ovoid, and usually narrower posteriorly, where an indentation is usually seen.
14. An apical sense-organ appears early in the embryo, and is present in the larva in the form of a white area surrounded by a dark ring of pigment-spots.
15. The larva is uniformly ciliated, and progresses actively over the surface on which it occurs. It is not free-swimming, and rapidly sinks to the bottom when placed in the water. It secretes a viscid substance, by means of which it adheres somewhat securely to the substratum. The ventral surface has a thickened foot-like area.

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APPENDIX. By SIDNEY F. HARMER, Sc.D., F.R.S.

The manuscript of the paper printed above was forwarded to me by Dr. Gilchrist in a letter dated May 12, 1915, with the request that I would arrange for its publication. Species of *Cephalodiscus* have so seldom been observed in the living condition that the observations recorded cannot fail to be of interest.

Dr. Gilchrist states in his letter that he has been unable to refer to some of the recent literature, and in particular to the important memoir by K. A. Andersson (6), of which he has been unable to find a copy at Cape Town; and he asks me to do what I can to remedy the omission. I may be permitted, therefore, to add a few notes on his communication.

The evidence brought forward to show that *C. gilchristi* does not grow on the muddy ground on which it has been obtained by Dr. Gilchrist in considerable quantities is very interesting. It appears that the Cape species probably grows on rocky ground, from which it may be detached and carried by currents to the muddy areas from which it has been trawled.

Dr. Gilchrist's observation that the zooids are sometimes found in large numbers crawling on the outer surface of the cœnœcium agrees with the description of living specimens of *C. dodecalophus* and *C. inæquatus* (probably = *C. hodgsoni*, Ridewood; *cf.* Harmer and Ridewood, 9, p. 559) which has been given by Andersson (6, p. 15).

The notes on the behaviour of the living zooids are a distinct addition to our knowledge of the genus; and the remarks on the solution of the normal pigments by preserving fluids, and on their redeposition in the tissues of the zooids from the solution, have a distinct bearing on the interpretation of the pigments in the preserved material of other species. Some indication that this is the case has already been recorded in the paper by Ridewood and myself (9, p. 544).

Dr. Gilchrist thinks that "there is no evidence that the buds ever develop into normal zooids, and they may be individuals specialized for adhesive purposes and cœnœcium-building." I venture to think that this opinion cannot be maintained. The occurrence of almost innumerable individuals in a single colony almost necessarily presupposes that the number of individuals increases by budding; while Dr. Gilchrist's observation that several zooids may occur in the individual cœnœcial tubes of *C.* (*Idiothecia*) *gilchristi* indicates, in all probability, that some of the buds have assumed an adult character.

It is to be hoped that Dr. Gilchrist will be successful in elucidating further the structure and the metamorphosis of the embryos and free larvæ which he has observed in the living condition. In his covering letter he states that some of his embryos show traces of five body-cavities. It is in this part of his paper that he has been most handicapped by the want of literature; and I subjoin one or two notes on what has already been done in investigating the embryonic development.

Omitting one or two fragmentary remarks on embryos of

C. dodecalophus to which I have referred in my 'Siboga' Report (2, p. 102), the first record of the characters of the larvæ was given by Andersson (5), who observed free planula-like larvæ in the living condition. I have myself given some account of the early development of *C. levinseni* and *C. gracilis*. Somewhat later, Andersson (6) published a fuller account of the observations referred to in his preliminary note, recording a number of facts with regard to the early development of *C. dodecalophus*, *C. inæquatus*, *Orthoecus solidus*, and *O. densus*. Schepotieff (7) has described the early development of *C. indicus*; while Braem (8) has published a paper, based on the results recorded in the memoirs above cited, in which he attempts to demonstrate that the similarity previously noticed between the larvæ of *Cephalodiscus* and those of Ectoproct Polyzoa is an indication of genetic affinity, and that it is accompanied by fundamental resemblances in structure between the two types of larvæ. I may remark, in passing, that I am not satisfied that Braem's comparisons will hold good; and in particular this author does not seem to me to have taken sufficiently into account the fact that the larvæ of Ectoprocta show no trace of the *Balanoglossus*-like disposition of the cœlomic cavities which appears to be demonstrated in the larvæ of *Cephalodiscus*.

The accounts which have been given of the development in the memoirs already noticed are in close agreement with one another; and the following facts appear to be clearly established:—

(i.) The egg of *Cephalodiscus* is of considerable size—reaching a diameter of 680 μ in *Orthoecus solidus*—and it contains a large quantity of yolk.

(ii.) Segmentation is complete and leads to the formation of a gastrula-like stage, although the mode of origin of the inner layer has not been definitely established. The lumen of the archenteron is very small, in correlation with the large amount of yolk.

(iii.) The yolk is present in the cells of the inner and outer layers in the earlier stages of development; but it later disappears from the outer layer, persisting in large quantity in a central mass representing the wall of the archenteron, the cavity of which remains very small.

(iv.) The wall of the archenteron is continuous with the outer layer, in the later stages observed, near the posterior pole of the embryo. This region may be regarded as the blastopore, and it seems probable that it gives rise to the anus.

(v.) The free-swimming larva and the later embryos possess five body-cavities arranged like those of the adult—namely, a large anterior cavity and two pairs of clearly marked cœlomic sacs, representing the body-cavities of the collar and metasome respectively. These cavities are, perhaps, developed as enterocœles.

(vi.) A large area of the ventral ectoderm, which belongs in the main to the anterior half, but generally extends considerably beyond the middle of the larva, is much thickened, and is occupied by numerous gland-cells resembling those of the anterior or "ventral" wall of the adult proboscis or buccal shield, and probably gives rise to that part of the zooid.

(vii.) The anterior pole of the larva is provided with a mass of clear vacuolated cells, situated in the ectoderm. This organ is, perhaps, of sensory nature, and in *C. indicus* it has been shown by Schepotieff (7) to bear a central tuft of long cilia and to be surrounded by a circlet of smaller cilia.

(viii.) With the exception of the cilia just indicated the larva is not known to carry definite rings of cilia, although part at least of its ectoderm is uniformly covered with short cilia.

(ix.) The posterior pole of the larva is generally provided with a definite ectodermic invagination of unknown nature. This has been described under the name of the "posterior pit" (2).

(x.) The deeper parts of the ectoderm of the larva already show signs of the development of a diffuse nerve-plexus.

It appears improbable that there is any pelagic stage, and the observations of Andersson seem to indicate that the larva becomes a zooid by direct metamorphosis. There is at present no evidence to show how the later stages of this change are accomplished, and observations on this subject and on the commencement of the formation of the cœnœcial tubes are specially required.

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EXPLANATION OF PLATE XI.

LARVA, × 295, of *Cephalodiscus gilchristi*, drawn from a living specimen. The anterior end of the larva is at the upper part of the Plate.

XXXI.—*On the Lepidoptera collected in* 1913–1914 *by Herr Geyr von Schweppenburg on a Journey to the Hoggar Mountains.* By Lord Rothschild, F.R.S., Ph.D.

Part I.

The journey on which these insects were collected was undertaken on behalf of Professor A. Koenig of Bonn by Herr Paul Spatz and Herr Geyr von Schweppenburg, and had as main object the collecting of birds, mammals, and reptiles.

They started from Biskra, and went down to Idelès *viâ* Touggourt, Ouargla, Aïn-Taïba, and Timassinin. No Lepidoptera were collected north of Touggourt, and the bulk of the 900 odd specimens were captured south of Timassinin.

Rhopalocera.

Papilionidæ.

Pierinæ.

(1) *Pieris rapæ ? leucotera*, Stef.

Pieris rapæ, var. *leucotera*, Stefanelli, Bull. Soc. Entom. Ital. 1869, p. 147 (Florence).

1 ♂, Ouargla, June 4, 1914.

(2) *Euchloë falloui obsolescens*, Rothsch.

Euchloe falloui obsolescens, Rothschild, Novit. Zool. vol. xx. p. 112. no. 6 (1913) (South Oued Mya).

1 ♀, Oued Ag’elil, N. of Idelès, March 19; 1 ♂, Idelès, March 20, 1914.

(3) *Teracolus helvolus*, Butl.

Teracolus helvolus, Butler, Proc. Zool. Soc. Lond. 1888, p. 94 (Somaliland).

1 ♂, 2 ♀ ♀, March 25, 1 ♂, March 27, 1914, Idelès.

(4) *Colias electo croceus* (Geoff. in Fourcr.).

Papilio croceus, Geoffroy, in Fourcroyer's Entomologia Parisiensis, vol. ii. p. 250 (1785) (Paris).

2 ♂ ♂, 3 ♀ ♀, and 1 ♀ form ♀ *helice*, Hübn., Ouargla, June 4, 1914.

Nymphalidæ.

NYMPHALINÆ.

(5) *Pyrameis cardui cardui* (Linn.).

Papilio cardui, Linnæus, Fauna Suecica, p. 276. no. 1054 (1761) (Sweden).

1 ♂, Jan. 26, 1 ♂, 2 ♀ ♀, Jan. 28, 1914, Timassinin; 1 ♂ Amgid, Feb. 16–18, 1914; 2 ♂ ♂, 1 ♀, Aïn Tahait, Feb. 21, 1914; 2 ♂ ♂, Idelès, March 27, 1914; 1 ♂, Ouargla, June 4, 1914.

Lycænidæ.

(6) *Zizera lysimon* (Hübn.).

Papilio lysimon, Hubner, Europ. Schmett. vol. i. figs. 534, 535 (1798–1803) (Europe).

1 ♂, 20 kil. S. of Ouargla, Dec. 23, 1913; 1 ♀, Ouargla June 4, 1914.

(7) *Tarucus theophrastus* (Fabr.).

Hesperia theophrastus, Fabricius, Entom. System. vol. iii. part 1, p. 281. no 32 (1793) (Morocco).

1 ♂, Amgid, Feb. 16–18, 1914; 2 ♂ ♂, Oued Ag'elil, N. of Idelès, March 18, 1914.

(8) *Spindasis acamas divisa*, subsp. n.

Differs from *a. acamas*, Klug, in having the upperside of *a. bellatrix*, Butl., whilst the underside is that of typical *a. acamas*.

1 ♀, Oued Ahmra, N. of Idelès, April 9, 1914.

(9) *Virachola livia* (Klug).

Lycæna livia, Klug, Symb. Phys. t. xl. figs. 3–6 (1834) (between Kineh and Assouan).

1 ♀, Ain Tahait, Feb. 21, 1914; 1 ♂, 1 ♀, Oued Ag'elil, March 19, 1914; 1 ♂, Idelès, March 25, 1914.

HETEROCERA.

Sphingidæ.

CHŒROCAMPINÆ.

(10) *Celerio lineata livornica* (Esp.).

Sphinx livornica, Esper, Schmett. ii. p. 196 (1779) (Europe).

1 ♂, 30 kil. N. of Amgid, Feb. 10, 1914; 4 ♂ ♂, 2 ♀ ♀,

Amgid, Feb. 13 & 19, 1914 ; 1 ♂, Aïn Tahart, Feb. 21, 1914 ; 3 ♂ ♂, 3 ♀ ♀, Timenaiin, March 3, 1914 ; 1 ♂, Oued Ag'elil, March 19, 1914.

Lymantriidæ.

(11) *Casama uniformis* (Rothsch.).

Ocneria uniformis, Rothschild, Novit. Zool. vol. xx. p. 118. no. 22 (1913) (South Oued Mya).

After I had first described this insect, Sir George Hampson was of opinion that it was the same as *innotata*, Wlk. ; but now that the ♂ has turned up, he agrees with me that it is distinct.

♂. Has much shorter and rounder wings than ♀, and has thorax and fore wings washed and powdered with brown ; hind wings wood-grey, not cinnamon-white.

1 ♂, Amgid, Feb. 16–18, 1914 ; 1 ♀, Ti-n-tabarik, April 14, 1914 ; 2 ♀ ♀, Aïn Tahart, April 19, 1914 ; 2 ♀ ♀, Tahihout, April 28, 1914.

Lasiocampidæ.

(12) *Chilena geyri*, sp. n.

♂. Antennæ, shaft white, pectinations olive-rufous-brown ; head, thorax, and abdomen clothed with long whitish-grey hairs strongly intermixed with pale cinnamon-brown ones.

Fore wing pale grey densely irrorated with cinnamon-brown scales ; a white spot in cell ; a postmedian band of dark brown spots.

Hind wing yellowish mouse-grey irrorated with cinnamon.

The series is somewhat variable, owing to the basal ⅔ of fore wing being sometimes more sometimes less irrorated with dark scales ; the size of white cell-spot is also variable.

Length of fore wing 18–21 mm. ; expanse 42–48 mm.

9 ♂ ♂, 25 kil., and 1 ♂, 50 kil. S. of Bledet Ahmar, Dec. 16 & 25, 1913.

(13) *Chilena malacosomoides*, sp. n.

♂. Antennæ gallstone-yellow ; head, thorax, and abdomen pale pinkish cinnamon.

Fore wing cinnamon-grey, a double antemedian zigzag line and a median similar one, the outer portion of which is very faint brown ; these antemedian and median double lines are joined by crossed lines on vein 1. A postmedian, fainter, very sinuate line also brown.

Hind wing cinnamon-grey.
Length of fore wing 14 mm.; expanse 32 mm.
1 ♂, Oued Tamoudat, N. of Idelès, March 22, 1914.

Noctuidæ.

AGROTINÆ.

(14) *Chloridea nubigera* (Herr.-Sch.).

Heliothis nubigera, Herrich-Schaffer, Syst. Bearb. Schmett. Europ. vol. ii. p. 360 (1845) (Europe).

1 ♂, Oued Ahmia, March 15, 1914; 1 ♂, 1 ♀, Oued Ag'elil, March 18 & 19, 1914; 1 ♂, Oued Dehin, March 20, 1914.

(15) *Chloridea peltigera* (Schiff.).

Noctua peltigera, Schiffermuller, Syst Verz. Schmett. Wien, p. 89 (1776) (Vienna).

1 ♂, Oued Ag'elil, March 19, 1914.

(16) *Euxoa hodnæ* (Oberth.).

Agrotis hodnæ, Oberthur, Etud. Entom. fasc. iii. p. 45, pl. v. fig. 8 (1878) (Bou Saada).

Oberthur afterwards sank his *hodnæ* as an aberration of *spinifera*, and so did Sir George Hampson in vol. iv. p. 177 of the 'Catalogue of Lepidoptera Phalænæ.' Now, however, since large numbers of *hodnæ* from Algeria have come to hand, it is quite clear it is a distinct species. It differs structurally from *spinifera* in having serrate, NOT pectinate antennæ.

The ground-colour varies from dark cinnamon-brown to whitish buff.

1 ♂, 1 ♀, Oued Abou, Jan. 19, 1914; 2 ♀ ♀, Oued Ag'elil, March 18 & 19, 1914; 1 ♀, Oued Tamoudat, March 22, 1914; 1 ♂, 1 ♀, 20 kil. N. of Idelès, March 31, 1914.

(17) *Euxoa segetum* (Schiff.).

Noctua segetum, Schiffermuller, System. Verz. Schmett. Wien, pp. 81 & 252, figs. 3 *a*, *b* (1776) (Vienna).

2 ♀ ♀, Idelès, March 27 & 29, 1914.

(18) *Agrotis ypsilon* (Rott.).

Noctua ypsilon, Rottenburg, Naturforscher, vol. ix. p. 41 (1776) (Europe).

4 ♂ ♂, 5 ♀ ♀, Timassinin, Jan. 28 & 30, 1914; 3 ♂ ♂,

3 ♀ ♀, I-n-Kelemet, Feb. 6–8, 1914; 15 ♂ ♂, 7 ♀ ♀, 30 kil. N. of Amgid, Feb. 10, 1914; 11 ♂ ♂, 9 ♀ ♀, Feb. 13, 5 ♂ ♂, Feb. 16–18, 1914, Amgid; 1 ♂, 2 ♀ ♀, Aïn Tahart, Feb. 21, 1914; 1 ♂, Oued Ag'elil, March 18, 1914; 1 ♂, 20 kil. N. of Idelès, March 21, 1914.

CUCULLIANÆ.

(19) *Copicucullia syrtana* (Mab.).

Cucullia syrtana, Mabille, Bull. Soc. Entom. France, 1888, p. 51 (Gabès, Tunis).

3 ♂ ♂, 1 ♀, Oued Abbou, Jan. 17 & 19, 1914.

(20) *Cucullia santolinæ*, Ramb.

Cucullia santolinæ, Rambur, Ann. Soc. Entom. France, vol. iii. p. 387, pl. viii. fig. 4 (1834) (Corsica).

1 ♂, 25 kil. S. of Bledet Ahmar, Dec. 16, 1913.

(21) *Cleophana chabordis*, Oberth.

Cleophana chabordis, Oberthur, Etud. Entom. fasc. i. p. 47, pl. ii fig. 2 (1876) (Bou Saada).

1 ♂, Oued Ahmra, N. of Idelès, April 4, 1914.

(22) *Ammetopa codeti*, Hmpsn.

Ammetopa codeti, Hampson, Cat. Lepid. Phal. Brit. Mus. vol. vi. p. 120, no. 2222, fig. 32 (1906) (Biskra).

1 ♂, Oued Ahmra, April 5, 1914.

(23) *Antitype sahariensis*, sp. n.

♂. Antennæ golden brown; head and thorax cinnamon-pink mixed with cinnamon-brown; abdomen bright cinnamon-buff.

Fore wing dark cinnamon-pink, basal $\frac{1}{5}$ variegated with grey; a broad oblique antemedian band grey; a large, wedge-like, irregular postmedian patch from costa to vein 2 yellowish grey; a subterminal band of greyish marks.

Hind wing wood-grey, fading to whitish on basal half; a terminal double line, black within, buff outwardly.

Length of fore wing 17 mm.; expanse 40 mm.

1 ♂, Rharis, April 16, 1914.

ACRONYCTINÆ.

(24) *Laphigma exigua junceti* (Zell.).

Caradrina junceti, Zeller, Isis, 1847, p. 445 (Sierra Nevada).

1 ♂, Oued Abbou, Jan. 17, 1914; 1 ♂, 1 ♀, Jan. 26, 15 ♂♂, 17 ♀♀, Jan. 30, 1914, Timassinin; 2 ♂♂, I-n-Kelemet, 6–8 Feb. 1914; 1 ♂, 30 kil. N. of Amgid, Feb. 10, 1914; 8 ♂♂, 3 ♀♀, Amgid, Feb. 16–18, 1914; 1 ♀, Temenaiin, March 3, 1914; 1 ♂, Oued Ag'elil, March 19, 1914; 1 ♂, Oued Dehin, March 20, 1914; 1 ♂, Oued Gif-Aman, March 21, 1914.

(25) *Athetis oberthuri*, Rothsch.

Athetis oberthuri, Rothschild, Novit. Zool. vol. xx. p. 126. no. 57 (1913) (South Oued Mya).

1 ♀, Rharis, April 16, 1914.

(26) *Athetis flava* (Oberth.).

Caradrina flava, Oberthur, Etud. Entom. fasc. i. p. 45, pl. iv. fig. 3 (1876) (Province Oran).

1 ♂, Temenaiin, March 6, 1914; 1 ♂, Oued Ag'elil, March 18, 1914; 1 ♀, Oued Dehin, March 20, 1914.

(27) *Azenia sabulosa* (Rothsch.).

Eublemma sabulosa, Rothschild, Novit. Zool. vol. xx. p. 127. no. 64 (1913) (South Oued Mya).

1 ♀, Amgid, Feb. 19, 1914.

ERASTRIANÆ.

(28) *Eublemma geyri*, sp. n.

♀. Antennæ brown, shaft above white; head and tegulæ brownish purple, rest of thorax and abdomen pinkish cream-white.

Fore wing pinkish cream-white; a postmedian large round spot black with lavender centre; a very sinuate post-discal band blue-grey; termen and fringe broadly brownish purple.

Hind wing whitish cream; a terminal hair-line dark brown.

Length of fore wing 6 mm.; expanse 14 mm.

3 ♀♀, Tahihaout, April 28, 1914.

(29) *Eublemma griseola* (Ersch.).

Thalpochares griseola, Erschoff, Fedtsch. Reise, p. 51, pl. fig. 55 (1874) (Persia).

1 ♀, Acceksem, April 13, 1914; 2 ♀ ♀, Ti-n-tabarik, April 14, 1914; 1 ♀, Aïn Tahart, April 19, 1914.

(30) *Eublemma albidior*, sp. n.

♂ ♀. Entirely cream-white, slightly washed with buff on fore wing.

Length of fore wing, ♂ 7, ♀ 9 mm.; expanse, ♂ 16, ♀ 20 mm.

1 ♀, Idelès, March 29, 1914; 1 ♂, 2 ♀ ♀, Oued Ahmra, April 4 & 5, 1914; 1 ♂, Amgid, April 22, 1914. (Type ♂, Oued Ahmra.)

(31) *Eublemma deserta* (Stdgr.).

Thalpochares deserta, Staudinger, Iris, vol. xii. p. 383 (1899) (Biskra).

1 ♂, Timassinin, Jan. 30, 1914; 1 ♂, 2 ♀ ♀, Oued Ag'elil, March 18, 1914; 1 ♀, Oued Dehin, March 20, 1914; 1 ♀, Idelès, March 25, 1914; 1 ♀, 20 kil. N. of Idelès, March 31, 1914; 12 ♀ ♀, Oued Tamoudat, March 22, 1914; 1 ♂, 2 ♀ ♀, Oued Ahmra, April 4 & 5, 1914; 3 ♀ ♀, Acceksem, April 13, 1914; 8 ♀ ♀, Ti-n-Tabarik, April 14, 1914; 5 ♀ ♀, Aïn Tahart, April 19, 1914; 2 ♀ ♀, Amgid, April 22, 1914; 2 ♀ ♀, Tahihout, April 28, 1914.

(32) *Eublemma deserti* (Rothsch.).

Thalpochares deserti, Rothschild, Entom. Zeit. Stuttgart, vol. xxiii. p. 142 (1909) (Mraier).

1 ♀, Aïn Taïba, May 23–25, 1914.

(33) *Eulocastra diaphora atribasalis* (Hmpsn.).

Metachrostis atribasalis, Hampson, Proc. Zool. Soc. Lond. 1896, p. 261, pl. x. fig. 11 (Aden).

1 ♂, Oued Gif-Aman, March 21, 1914; 1 ♂, Oued Tamoudat, March 22, 1914; 1 ♂, Oued Ahmra, April 4, 1914; 1 ♀, Ti-n-Tabarik, April 14, 1914.

CATOCALINÆ.

(34) *Anydrophila sabourodi* (Luc.).

Palpangula sabourodi, Lucas, Bull. Soc. Entom. France, 1907, p. 180 (Zarcine, Tunis).

1 ♂, Acceksem, April 13, 1914.

(35) *Leucanitis kabylaria*, Bang-Haas.

Leucanitis kabylaria, Bang-Haas, Iris, vol. xix. p. 136, pl. v. fig 7 (1906) (Gafsa, Tunis).

14 ♂♂, 14 ♀♀, Amgid, 13–19 Feb. 1914; 1 ♀, N. of Idelès, March 10, 1914; 1 ♂, 1 ♀, Oued Ag'elil, March 18 & 19, 1914; 1 ♂, Oued Dehin, March 20, 1914; 1 ♀, Oued Gif-Aman, March 21, 1914.

(36) *Hypoglaucitis benenotata moses*, Stdgr.

Hypoglaucitis moses, Staudinger, Iris, vol. vii. p. 284, pl. ix. fig. 17 (1894) (Cairo).

I have put these two specimens down tentatively as *b. moses*, Stdgr., because the desert insects are so widespread and so variable that it is hazardous to describe them as new. But they differ from both *b. benenotata*, Warr., and *b. moses* in the almost obsolete markings of the fore wings and the less defined dark terminal band on the hind wings.

1 ♀, Aceksem, April 13, 1914; 1 ♀, Tahihout, May 1, 1914.

(37) *Clytie arenosa*, Rothsch.

Clytie arenosa, Rothschild, Novit. Zool. vol. xx. p. 128. no. 69 (1913) (South Oued Mya).

1 ♀, Tahihout, April 18, 1914.

(38) *Clytie delunaris* (Stdgr.).

Pseudophia delunaris, Staudinger, Stett. Entom. Zeit. 1889, p. 56 (Askhabad).

1 ♀, Oued Ahmra, March 15, 1914; 5 ♀♀, Oued Ag'elil, March 18 & 19, 1914; 3 ♂♂, 5 ♀♀, Oued Gif-Aman, March 21, 1914; 1 ♂, Oued Tamoudat, March 22, 1914; 1 ♂, Idelès, March 27, 1914; 1 ♂, 1 ♀, 20 kil. N. of Idelès, March 31, 1914.

(39) *Cortyta rosacea*, Rebel.

Pericyma rosacea, Rebel, Denkschr. Math.-Nat. Akad. Wissensch. vol. lxxi. p. 60 (1907) (Socotra).

3 ♂♂, Amgid, Feb. 19, 1914; 4 ♂♂, 8 ♀♀, Oued Dehin, March 20, 1914; 3 ♀♀, Oued Gif-Aman, March 21, 1914; 2 ♂♂, 1 ♀, Oued Tamoudat, March 22, 1914; 1 ♀, 20 kil. N. of Idelès, March 31, 1914; 1 ♀, Oued Ag'elil, April 2, 1914; 2 ♀♀, Aceksem, April 13, 1914; 2 ♂♂, Rharis, April 15, 1914.

(40) *Cortyta vetusta acrosticta* (Püng.).

Pericyma acrosticta, Püngler, Iris, vol. xvi. p. 289, pl. vi. fig. 6 (1903) (Palestine).

1 ♀, Ti-n-tabarik, April 14, 1914.

(41) *Cortyta dispar* (Püng.).

Pericyma dispar, Püngler, Iris, vol. xvi. p. 290, pl. vi. figs. 7, 7 *a* (1903) (Palestine).

2 ♀ ♀, Amgid, Feb. 19, 1914; 1 ♂, 1 ♀, Oued Dehin, March 20, 1914; 2 ♀ ♀, Oued Gif-Aman, March 21, 1914; 1 ♂, 3 ♀ ♀, Oued Tamoudat, March 22, 1914.

(42) *Cortyta leucoptera* (Hmpsn.).

Hypaetra leucoptera, Hampson, Proc. Zool. Soc. Lond. 1896, p. 264, pl. x. fig. 1 (Aden).

1 ♂, Amgid, Feb. 20, 1914; 1 ♀, Oued Amra, April 4, 1914; 1 ♂, Rharis, April 16, 1914.

(43) *Cortyta fasciolata* (Warr.).

Pericyma fasciolata, Warren, Novit. Zool. vol. xii. p. 24, pl. iv. figs. 11, 21 (1905) (Nakheila, Atbara).

1 ♀, Amgid, Feb. 16–18, 1914; 1 ♀, Aïn Tahart, Feb. 21, 1914; 1 ♀, Rharis, April 16, 1914.

(44) *Cortyta impar*, Hmpsn.

Cortyta impar, Hampson, Cat. Lepid. Phal. Brit. Mus. vol. xiii. p. 317, no. 8129 (1913) (Punjab).

1 ♀, Aïn Tahart, April 16, 1914.

(45) *Cortyta pungleri*, sp. n.

♀. Allied to *metaxantha*, Hmpsn., but at once distinguished by the large apical dark spot.

Basal ¼ of fore wing slate-grey, median ⅓ sandy brown, outer ⅓ pale sandy; ante- and postmedian lines strongly sinuate, black.

Hind wing buff, marginal line black; a clouded obsolescent band runs in from above tornus to median vein near cell.

Length of fore wing 14–15 mm.; expanse 31–33 mm.

1 ♀, Oued Dehin, March 20, 1914; 1 ♀, Oued Gif-Aman, March 21, 1914. (Type, Oued Gif-Aman.)

PHYTOMETRINÆ.

(46) *Phytometra ni deserticola* (Rothsch.).

Plusia ni deserticola, Rothschild, Novit. Zool. vol. xx. p. 129 (1913) (El Golea).

1 ♂, Amgid, Feb. 16–18, 1914; 1 ♂, Oued Ahmra, March 14, 1914; 2 ♂ ♂, Aïn Tahart, March 21, 1914.

(47) *Phytometra gamma* (Linn.).

Phalæna gamma, Linnæus, System. Nat. ed. x. p. 513. no. 91 (1758) (Sweden).

1 ♂, Slassel Dhanoun, Dec. 29, 1913.

NOCTUINÆ.

(48) *Pandesma anysa terrigena* (Chr.).

Pericyma terrigena, Christoph, Hor. Soc. Entom. Ross. vol. xii. p. 254. no. 21, tab. vi. fig. 27 (1876) (Krasnowodsk).

1 ♂, 1 ♀, I-n-Kelemet, Feb. 6–8, 1914; 1 ♂, 4 ♀ ♀, Amgid, Feb. 13, 1914; 1 ♂, Aïn Tahart, Feb. 21, 1914; 1 ♂, Oued Ahmra, March 14, 1914; 1 ♂, Oued Ag'elil, March 18, 1914.

(49) *Imitator straminea* (Bang-Haas).

Palpangula straminea, Bang-Haas, Iris, vol. xix. p. 135, tab. v. fig. 11 (1906) (Gafsa, Tunis).

5 ♂ ♂, 4 ♀ ♀, 25 kil. S. of Bledet Ahmar, Dec. 16, 1913; 4 ♀ ♀, 20 kil. S. of Ouargla, Dec. 24, 1913; 7 ♂ ♂, 21 ♀ ♀, 50 kil. S. of Ouargla, Dec. 25, 1913; 3 ♀ ♀, Slassel Dhanoun, Dec. 29, 1913; 1 ♂, Hassi Abbou, Jan. 16, 1914; 6 ♂ ♂, 23 ♀ ♀, Oued Abbou, Jan. 17, 1914; 2 ♀ ♀, Timassinin, Jan. 30, 1914; 2 ♂ ♂, 5 ♀ ♀, I-n-Kelemet, Feb. 6–8, 1914; 5 ♂ ♂, 6 ♀ ♀, Amgid, Feb. 16–18, 1914.

(50) *Anumeta major*, Rothsch.

Anumeta major, Rothschild, Novit. Zool. vol. xx. p. 130. no. 79 (1913) (N. of El Golea).

In 'Novitates Zoologicæ,' vol. xxii. p. 234, under no. 46 I stated I had received from Herr Geyr von Schweppenburg 10 ♂ ♂ and 5 ♀ ♀ of this species. On close examination this proves to be erroneous. Of Herr Geyr's 15 specimens 10 ♂ ♂ and 2 ♀ ♀ prove to belong to a new species described below, while 2 ♂♂ and 1 ♀ only belong to *major*. The ♂ of *major* is similar to the ♀, but has the fore wings much more closely sprinkled with lavender-grey scales, giving it a paler and more mealy appearance.

2 ♂♂, 1 ♀, Aïn Taïba, May 23–25, 1914.

(51) *Anumeta spatzi*, sp. n.

♂. Antennæ brown; head, thorax, and abdomen buffish cream-white, as OPPOSED to the SHARPLY DIVIDED brown and grey head and thorax and cream-white abdomen in ♂ *major*.

Fore wing buffish sand-colour; two streaks on costa, a large streak from base to end of cell along median vein, and a broad postdiscal band much indented pale brown; this postdiscal band is edged outwardly by a whitish-buff line; a subapical spot and a terminal row of wedge-like dots black.

Hind wing: basal half, abdominal margin and fringe cream-white; rest of wing pale wood-grey; a large whitish subterminal patch between tornus and vein 3 in which is a large oval or quadrate black spot; a crenulate dark brown terminal line.

♀ similar but darker, and markings on fore wings much stronger; basal half of hind wing rusty wood-grey.

Length of fore wing, ♂ 20 mm., ♀ 21 mm.; expanse, ♂ 45 mm., ♀ 48 mm.

7 ♂♂, 1 ♀, Amgid, April 21, 1914; 2 ♂♂, 1 ♀, Tahihout, May 1, 1914; 1 ♂, Ain Taiba, May 23–25, 1914. (Type ♂, Amgid.)

(52) *Anumeta atrosignata harterti*, Rothsch.

Anumeta henkei harterti, Rothschild, Novit. Zool. vol. xx. p. 469 (1913) (S. of El Golea).

In vol. xxii. p. 234, under no. 46, I drew attention to the fact that Sir George Hampson, in his forthcoming volume xiv. of the 'Catalogue,' is uniting both *spilota*, Ersch. and my *harterti* as identical with *atrosignata* of Walker. I cannot agree with him in this. Although desert insects are certainly very widespread, I find the species of the genus *Anumeta* vary locally very considerably. The truth is that *atrosignata* is divisible into three quite recognisable local races, and must stand as follows:—

Anumeta atrosignata atrosignata, Walk.—Western India, Scind.

Much paler and smaller, markings indistinct.

Anumeta atrosignata spilota, Ersch.—Transcaspia.
Larger, much darker, fore wings distinctly marked.

Anumeta atrosignata harterti, Rothsch.—Central Western Sahara.
Much brighter coloured, more sandy red, and bands on fore wing extremely strongly marked.

4 ♂♂, 1 ♀, Amgid, Feb. 19 & April 21, 1914; 1 ♀, Acekseim, April 13, 1914; 1 ♂, 1 ♀, Tahihout, April 19 & May 1, 1914.

(53) *Anumeta sabulosa*, Rothsch.

Anumeta sabulosa, Rothschild, Novit. Zool. vol. xx. p. 129. no. 78 (1913) (South Oued Mya).

8 ♂♂, 1 ♀, Amgid, Feb. 19 & April 25, 1914; 2 ♀♀, Oued Dehin, March 20, 1914; Ain Tahaut, April 19, 1914.

(54) *Anumeta hilgerti* (Rothsch.).

Palpangula hilgerti, Rothschild, Entom. Zeit. Stuttgart, vol. xxiii. p. 142 (1909) (Bordj Ferjan).

1 ♀, Timassinin, Jan. 26, 1914; 3 ♂♂, 6 ♀♀, Amgid, Feb. 16–18 & April 22, 1914; 1 ♂, Oued Amia, March 15, 1914; 1 ♂, 1 ♀, Oued Gif-Aman, March 21, 1914; 1 ♂, 2 ♀♀, Oued Dehin, March 20, 1914; 2 ♀, 20 kil. N. of Idelès, March 31, 1914; 1 ♀, Aïn Taïba, May 23–25, 1914.

(55) *Apopestes cataphanes roseata* (Rothsch.).

Spintherops roseata, Rothschild, Novit. Zool. vol. xix. p. 126 (1912) (Ghardaia).

1 ♂, Oued Abbou, Jan. 17, 1914.

(56) *Apopestes dilucida rosea* (Staud.).

Spintherops dilucida, var. *rosea*, Staudinger, Stett. Entom. Zeit. vol. xlix. p. 63 (1888) (Biskra).

1 ♂, 20 kil. S. of Ouargla, Dec. 24, 1913; 1 ♂, Oued Abbou, Jan. 19, 1914.

(57) *Tathorhynchus exsiccata* (Led.).

Spintherops exsiccata, Lederer, Verhand. zool.-bot. Gesell. Wien, 1855, p. 204, pl. ii. fig. 12 (Syria).

1 ♂, 1 ♀, Amgid, Feb. 16–18, 1914; 1 ♂, Oued Ag'elil, March 19, 1914.

[To be continued.]

XXXII.—*Notes on the* Tabanidæ *of the Australian Region.* By GERTRUDE RICARDO.

[Concluded from p. 40.]

THE genera *Silvius*, *Chrysops*, and *Ectenopsis* are included in this paper, with four new genera, all in the Pangoninæ division of the Tabanidæ, and, with the last group of the Tabaninæ, comprising the subgenus *Therioplectes*, added, concludes the work on the family of Tabanidæ.

More material to add to the Brit. Mus. Coll. will be most welcome, and will be gladly identified by the writer of this paper.

PANGONINÆ.

SILVIUS, Meigen.

Syst. Beschreib. iii. p. 27 (1820).
See Ricardo, Ann. & Mag. Nat. Hist. (7) viii. p. 296 (1901).

The species of *Silvius* as yet recorded from Australia are :—

Silvius marginatus, ♀, Walker.
? *Silvius nitescens*, ♂, Walker.
Silvius silvester, Bergroth.
Silvius marsoni, Summers.
Silvius alcocki, Summers.
Silvius strangmanni, Summers.
Silvius lunulatus, Bigot, described by him under *Tabanus*.
Silvius lurida, Walker, described by him under *Pangonia*.

To these four new species are now added.

All the old species are represented in the Brit. Mus. Coll. except Bergroth's species, of which I have no knowledge; it is described as from Central Queensland, a small blackish species with two black-brown discal spots on the abdomen.

On the species from New Guinea, see Ricardo, 'Résultats Expéd. Sci. Néerlandaise, Nouvelle Guinée,' vol. ix., Zoologie, livr. 3, p. 387 (1913).

Silvius lunulatus, ♀, Bigot, Mém. Soc. Zool. de France, v. p. 688 (1892) [*Tabanus*].

This female type in the Verrall Coll. is not a *Tabanus* species, but apparently a species of *Silvius*, though, the antennal third joint, the palpi, and proboscis being broken off, it is difficult to decide; but ocelli and small spines on the tibiæ are present.

It is a brownish-coloured small fly, with paler segmentations on the abdomen, covered with white hairs, and the thorax has grey tomentose stripes. The forehead is parallel, with a small reddish-brown frontal callus, reaching the eyes, which are bare. Legs reddish yellow. Wings clear.

Length 11 mm.

Silvius lurida, ♀, Walker, List Dipt. i. p. 140 (1848) [*Pangonia*]; Ricardo, Ann. & Mag. Nat. Hist. (7) v. p. 121 (1900).

Type (female) from Port Stephen, New South Wales, with a note, "Very troublesome to man and cattle," and another female from Swan River, W. Australia.

This type and the other female are both in bad condition, but as they clearly possess ocelli and spines on the hind tibiæ, they do not belong to any genera of the Tabaninæ, and the antennæ having only five divisions on the third joint precludes them from belonging to the genus *Pangonia*. The shape of the palpi, which are long and slender, with truncated tips as in *Silvius marsoni* and other species of *Silvius* from Australia, leads me to place them in this genus.

A rather large species compared with others of the genus. *Face* reddish, covered with grey tomentum. Beard white. *Palpi* long and slender, cylindrical, slightly dilated, and concave at base, with the tips truncated, yellowish in colour, about a third of the length of proboscis. *Antennæ* reddish, the third blackish; the first joint short, with some black pubescence, the second very small, cup-shaped, the third with the first division large and broad, the last four joints very small. Subcallus shining red, with traces of grey tomentum, protuberant and large. *Forehead* parallel, hardly more than three times as long as it is broad, with a large, broad, shining reddish stripe as frontal callus, ending posteriorly in a short point. *Eyes* bare. Ocelli distinct. *Thorax* appears reddish, with three dark stripes, covered with grey tomentum; it is probably very much denuded. *Scutellum* reddish. *Abdomen* reddish yellow, with traces of grey tomentum on the segmentations and on dorsum of apical segments; it is also much denuded. *Legs* reddish, the tarsi dusky. *Wings* clear, veins and stigma yellowish, the posterior cells all widely open, no appendix.

The above description is of the type only; the other female is probably identical, but the forehead seems narrower and the subcallus and frontal callus are darker in colour; the spines on hind tibiæ are present, though small; in the type the hind legs are destroyed.

Length of type 14½ mm.; other female 13, and its proboscis 3 mm.

Silvius doddi, ♀, sp. n.

Type (♀, from Mr. Wainwright's Collection) from Kuranda, Queensland, Sept. 1910 (*F. P. Dodd*), and another. Two females in German Ent. Museum Collection from Herberton, 3700 ft. (*Dodd*), and Cairns, N. Queensland; also a male from Herberton.

A small yellowish-brown species; antennæ and legs yellowish. Wings tinged yellowish brown.

Length 9½ mm., others 8 mm.

Face brown, with some paler tomentum and brown hairs on cheeks; furrows on each side of face deep, beard brownish. *Palpi* slender, the same width throughout, curved, yellowish, with dense but short dark pubescence, not quite so long as the proboscis. *Antennæ* bright reddish yellow, the first two joints paler yellow, with black pubescence, the third joint with the first division wide, the angle representing the tooth on the middle of upper border, the last four divisions small and narrow. *Forehead* almost parallel, slightly wider anteriorly, more than four times as long as it is wide, yellowish brown, with some blackish hairs, the frontal callus brown, almost lineal, the ocelli prominent. *Thorax* and *scutellum* reddish brown, with traces of grey tomentum and with scattered short yellow hairs; sides and breast the same, with black hairs. *Abdomen* yellowish or reddish on the first three or four segments, then becoming dark brown with the segmentations greyish and the sides yellowish; the brown colour appears more or less on the paler segments; pubescence chiefly black and unnoticeable, some yellow hairs fringing the posterior borders of the last segments; underside yellowish, dark at apex. *Legs* reddish yellow, with black pubescence. *Wings* tinged most deeply on anterior part; stigma brown, veins yellowish, with a short appendix, not always present.

The male is darker, the *palpi* with long black hairs, conical in shape, the face with some long hairs. *Eyes* distinctly pubescent, the hairs reddish. *Thorax* blackish (perhaps discoloured). *Abdomen* with the first segment black. *Legs* with the femora blackish.

Silvius frontalis, ♀, sp. n.

Type (♀) and another from Palmerston, N. Australia. In German Ent. Museum Collection.

A species rather similar in general appearance to *Silvius australis*, sp. n., but easily distinguished by the different shape of forehead and by the yellowish palpi and legs.

Length 9–9½ mm.

Face covered with greyish tomentum, a few dark hairs in centre and white hairs on cheeks. Beard white. *Palpi* yellowish, with black pubescence, long, cylindrical, curved. *Antennæ* reddish, the first two joints paler, with black hairs, the third dark at apex, with an obtuse angle at base of first division, which is large. *Forehead* same colour as face, parallel, about four times as long as it is broad; the frontal callus dark brown, shining, almost square, filling up the entire width of forehead, produced posteriorly or with an irregular border, from which proceeds a narrow spindle-shaped prolongation not quite reaching the ocelli. *Eyes* bare, with two distinct stripes. *Thorax* reddish brown, with four grey tomentose stripes; pubescence on these stripes whitish, elsewhere brown. Breast reddish, with grey tomentum and white and black hairs intermixed. *Scutellum* reddish, with traces of grey tomentum; a few long brown hairs are visible and some short white hairs. *Abdomen* reddish brown, the posterior borders of segments grey, tomentose; pubescence black and rather abundant, at sides on the grey bands silvery white: underside the same, the grey bands narrower. *Legs* yellowish, the femora darker, reddish brown, with white pubescence, which is also largely present on the tibiæ; elsewhere it is black. *Wings* clear, stigma yellow, veins darker yellow.

Silvius indistinctus, ♀, sp. n.

Type (female) and another in Brit. Mus. Coll. from Adelaide River, N. Australia.

Three females in Berlin Museum Collection from Palmerston, N. Australia.

A dull reddish-brown species; legs and antennæ the same colour. Abdomen with traces of lighter-coloured segmentations.

Length of type 12 mm., others 9–13 mm.

Face reddish yellow, covered with grey tomentum; some brownish hairs on cheeks. Beard dirty white in colour. *Palpi* long and slender, only slightly stouter at base, ending in a rounded point, two-thirds the length of the proboscis, reddish yellow, with some fine black pubescence. *Antennæ* same colour, the first two joints duller, with black hairs, the third joint wide at base, with a slight angle, not longer than the last four divisions together. *Forehead* the same colour, parallel, about five times as long as it is broad; the frontal callus almost square, taking up the whole width of forehead, shining blackish brown, with a lineal extension to the ocelli. *Eyes* bare. *Thorax* mahogany-coloured, with some grey tomentum; scutellum and breast the same. *Abdomen* reddish brown, darker at the apex; traces of paler bands on the second and third segments. *Legs* reddish yellow. *Wings* clear, with yellowish veins. No appendix.

Silvius australis, ♀, sp. n.

Type (female) and a series of females from Stannary Hills, N. Queensland, circa 3000 ft. (*Dr. T. L. Bancroft*), and a series of females in German Ent. Museum from Kuranda and Cairns, N. Queensland.

A small brown species, the abdomen with narrow grey bands; antennæ dull reddish. Legs blackish. Wings hyaline.

Length 9 mm.

Face covered with grey tomentum, a few white hairs on cheeks. Beard white. *Palpi* long, cylindrical, more than half the length of proboscis, slightly curved, reddish brown or blackish. *Antennæ* dull reddish, darker at apex, the first two joints with black hairs, the first division of third joint large, with an obtuse angle in place of tooth. *Forehead* same colour as face, broader anteriorly than at vertex, so that its length is only about double the width, measuring from the widest part above antennæ. Frontal callus brownish black, large, an elongated club-shape, the lower end reaching the ocelli and ending in a short point. *Eyes* bare. *Thorax* brown, with two distinct grey stripes, sides also grey. Breast greyish. *Scutellum* brown, with grey tomentum. *Abdomen* brown or blackish brown, the posterior borders of segments covered with grey tomentum, the pubescence dark on the brown, white on the tomentose borders; underside almost wholly covered with grey tomentum, the apex blackish. *Legs* blackish. *Wings* hyaline, no appendix, veins and stigma brown.

This species must be nearly allied to *Silvius silvester* (Bergroth), but in the description no mention is made of the forehead and the antennæ are described as blackish and the abdomen with yellow-haired bands. The type came from Central Queensland.

Mr. Marshall informs me that this species has been found at Cape York by Dr. MacGillivray.

Silvius notatus, ♀, sp. n.

Type (female) from Kalamunda, S.W. Australia, 850 ft., March 1914 (*R. E. Turner*), 1914, 258.

A badly preserved female from Mallee District, Victoria, in Mr. French's Coll. is probably a specimen of this species.

A black species, with four small white-haired spots on the abdomen, subcallus shining, forehead fairly broad. Palpi slender, with truncated tips, as in several species from Australia.

Length 13 mm.

Face covered with grey tomentum and with rather thick brown hairs on each side bordering the cheeks and a few in the centre. *Palpi* reddish yellow, wider at base and concave; the long slender point is longer than the basal half; pubescence consists of short black hairs, which are also present at the tip. Beard dirty white. *Antennæ* reddish brown, the first two joints with black hairs, the third with its basal division broad, showing a very slight angle, the last four joints very small. Subcallus protuberant, reddish brown and shining. *Forehead* slightly narrower anteriorly, about four times as long as it is broad, the ocelli very distinct, with grey tomentum round them, pubescence on forehead black. *Thorax* blackish, with grey tomentum, forming four stripes; sides reddish, with brownish hairs and white ones below on the breast, on dorsum with blackish-brown hairs. *Scutellum* same as thorax, with a fringe of chiefly white hairs. *Abdomen* blackish, covered with some grey tomentum, and with white hairs at sides; the four spots are situated on the third, fourth, and fifth segments in the middle of each segment, with their base resting on the posterior border, being in shape short, triangular; there are traces of one on the second segment; all the segmentations with white hairs; elsewhere the pubescence is blackish. *Legs* obscurely reddish yellow, the femora blackish, with white hairs; pubescence otherwise black. *Wings* clear, veins brown.

CHRYSOPS, Meigen.

Nouvelle Classification, p. 23 (1800).

Only two species of this genus have been recorded from the Australasian Region—*Chrysops testaceus*, Macq., and

Chrysops albicinctus, v. d. Wulp. This last is from New Guinea, the former from Tasmania.

One new species is now described.

Chrysops australis, ♀, sp. n.

Type (female) and another from Herberton, Queensland, 3700 ft. (*Dodd*), in German Ent. Museum.

Type (male) and others from Kuranda and Herberton in Mr. Wainwright's Coll., by the same collector.

A species with the usual dark brown band on wing, divided by a clear, distinct, narrow band from the pale brown apex. Abdomen brownish, with a pale yellow band on the second segment and a median yellow short stripe.

Length 10 mm.

Face honey-yellow, covered with grey tomentum, bare and shining in the centre. *Palpi* reddish yellow. *Antennæ* long and slender, the first two joints honey-yellow, with some black pubescence, about equal in length, the third equal in length to the two joints combined, stouter, the first division as long as the four succeeding ones, which are equal in size; the colour of this third joint is rather a darker shade than the others, and some very fine pubescence is apparent. *Forehead* black, with grey tomentum; the frontal spot is represented by a large brownish tubercle, not reaching the eyes; forehead broad; ocelli distinct. *Eyes* bare. *Thorax* reddish brown, shoulders with golden-yellow pubescence, which is continued in an oblique stripe on the breast; there is a tuft of similar hairs at base of wings. *Scutellum* same colour as thorax. *Abdomen* blackish brown, more reddish brown towards the apex; the dark colour on the second segment is represented as a half-circle, deeply indented on its posterior border by the median yellowish spot, all the anterior half of the segment and its sides being pale yellow or whitish; on the third and fourth segments the median spots are long and narrow; underside with the base of abdomen pale yellow. *Legs* reddish yellow, with black pubescence, the tarsi pale yellow, tibiæ a little incrassate. *Wings* with the fore border and the transverse band brown, and the whole apex paler brown, divided from the band by a white narrow band running across from the base of the fork of the third vein.

Male identical. *Palpi* with long brown hairs. *Eyes* contiguous, the large facets pale brass-colour, with two dark spots and a curved dark band on the outer posterior border of each eye, the small facets brown. *Thorax* and *scutellum* lighter in colour. *Abdomen* with the first segment more yellowish, and with hardly a trace of the blackish-brown band on posterior border; the dark colour on the second segment does not join in the centre, but is represented as a narrow black stripe on each side of the yellow spot, with the apex converging towards the centre.

Ectenopsis vulpecula, ♂ ♀, Wied. Aussereurop. Ins. i. p. 195 (*Chrysops*) (1828); Macq. Dipt. Exot. i. p. 116 (1838); Loew, Dipt. Südafrik. i. p. 15 (1860); Ricardo, Ann. & Mag. Nat. Hist. (7) viii. p. 297 (1901).

Pangonia angusta, ♂, Macq. Dipt. Exot., Suppl. ii p. 27 (1847).
Corizoneura angusta, ♀, Bigot, Mém. Soc. Zool. de France, v. p. 617 (1892).
Corizoneura rubiginosa, ♂, Bigot, *l. c.* p. 617.

Types of *Pangonia angusta* (three males), Macq., in the Verrall Coll., from New South Wales in very poor condition.

Type of *Corizoneura angusta* (female), Bigot, in the same Coll., from Australia.

Type of *Corizoneura rubiginosa* (male), Bigot, from Australia, in same Coll.

A series of females from Stannary Hills, N. Queensland (*Dr. T. L. Bancroft*), 1909 145, in Brit. Mus. Coll.

One female from Kuranda, N. Queensland, in the German Ent. Museum.

Two males from Kuranda and Herberton, N. Queensland (*Dodd*), in Mr. Wainwright's Coll.

Wiedemann described this species under *Chrysops*, but Macquart formed the genus *Ectenopsis* for it, considering that the prolongation of the face was its most striking characteristic. Loew remarks that Macquart had probably not seen the species, the type of which, described from an unknown locality, was in the Berlin Museum; and Loew considered the creation of a new genus unnecessary. A long series of the females of the species being now in the Brit. Mus. Coll., I have been able to establish the identity of Bigot's two types with it, and find that the antennæ have the third joint with *eight divisions*, which will necessitate removing it to the first division of the Pangoninæ, and precludes it being kept in the genus *Chrysops*. It must evidently be kept as a separate genus, reverting to Macquart's name.

The generic characteristics are the form of the *antennæ*, as above stated, the shape of the *face*, which is convex and short, the *forehead* being long and concave and broad; the proboscis is short, the *palpi* small, cylindrical. *Eyes* bare.

Abdomen long and narrow. *Wings* rather large, with the first posterior cell not at all narrowed at border.

A slender reddish-yellow species; the antennæ black at apex. Legs black and yellow. Wings clear.

Length 11 mm.; proboscis 1½ mm.

Female. Face and *forehead* raw-sienna in colour; the *antennæ* situated beyond the middle of the head, nearer the mouth; the face is short, convex, separated by a deep furrow from the small cheeks, quite bare; a few very short hairs are visible just below the antennæ. *Palpi* the same colour as face, but becoming darker towards the apex, with short black pubescence. Beard almost nil, represented by a few short reddish hairs. *Antennæ* same colour as face, the first two joints with some black hairs, the first joint short, the second only half its length, the third with the last four divisions deep black; the basal division is almost square, nearly as long as the second joint, the next three divisions small, the last four rather larger. *Forehead* wide, with no callus, wider anteriorly, about half as long as the length; between the subcallus and the vertex the forehead is concave; ocelli distinct. *Eyes* quite bare. *Thorax*, *scutellum*, and *abdomen* raw-sienna in colour, bare, a few same-coloured hairs on abdomen. Halteres black. *Wings* rather large, clear; appendix present, stigma blackish, veins black. *Legs* rather variable in colour, black, the femora usually yellowish, darker at their apices, all coxæ yellowish.

Bigot's type (*angusta*) has the legs entirely yellow, the tarsi a little darker. Wiedemann describes the legs as all black.

Male very similar, more hairy. *Palpi* almost the same in shape, with longer and more numerous black hairs; *face* also covered with brown hairs. *Eyes* with larger facets covering most of their surface, only leaving the lower third with small ones. *Thorax* rather darker in colour, with brown long pubescence; *scutellum* with yellowish hairs. *Abdomen* with long yellowish hairs at sides, somewhat darker at the apex. *Legs* with the femora yellowish or often largely black. In Bigot's types (*angusta*) they appear almost wholly reddish yellow. His type *rubiginosa* is in very bad condition, and the three male types of *angusta* are little better.

CÆNOPROSOPON, gen. nov.

Formed for two females from Blue Mts., New South Wales, in Mr. Wainwright's Coll.

The most striking characteristic in this species is the enormously large *palpi* in the type; unfortunately only the small first joint remains in the other female. The *antennæ* are small, the third joint with eight divisions, the first one small, stout, the others very small; the first two joints have heavy black pubescence. The *forehead* is very wide and concave, narrower at the vertex. Ocelli very distinct. Spines on hind tibiæ small, but very stout. *Wings* large, with all posterior cells open.

Cænoprosopon wainwrighti, ♀, sp. n.

A large fulvous-coloured species, with wings tinged brown.

Length 16½ mm., the other female 15 mm.; proboscis 2 mm.

Face amber-brown, with yellowish tomentum, the large tubercular upper part devoid of tomentum, with short black hairs and a bunch of them on the upper part of cheeks. Beard pale yellow. *Palpi* amber-brown, the first joint paler, short, stout; the second joint very large, flattened, club-shaped, curved, narrow at the extreme base, becoming wider; the whole surface on outer side covered with short black hairs, the inner side almost bare, the proboscis about a third longer than these palpi. *Antennæ* situated on the protuberant subcallus, the first two joints the colour of the face, the third joint redder, dusky at its extreme apex; the first joint short and stout, covered with stout black hairs, the second one the same, about half its length; the third joint with a ring-like first division, the second short and stout, the remaining ones narrower and very small. *Forehead* very wide, a third narrower at the apex, hollow in the centre, same colour as the face, devoid of pubescence. Ocelli large. *Eyes* small, with greenish reflections, bare. Head small in comparison with the size of insect. *Thorax* Sudan-brown, with two yellowish tomentose lateral stripes and a very narrow indistinct median one; the yellowish tomentum appears at sides and on the posterior half of dorsum, and wholly covers the scutellum; the pubescence consists of very short black hairs, on the scutellum of longer yellowish hairs. *Abdomen* amber-brown, but not very uniform in colour; an indistinct dark median stripe is visible, pubescence almost nil, a few short white hairs on the segmentations. *Legs* raw-sienna, the tibiæ somewhat paler; coxæ with some short black hairs; pubescence elsewhere yellowish. *Wings* large, brownish, becoming paler on the posterior border; veins reddish yellow; appendix rudimentary; all posterior cells open, but the fourth is narrower at the border.

DEMOPLATUS, gen. nov.

Formed for the male type named *Corizoneura trichocera* by Bigot; females are now to hand which are identical with this male. There are also three male specimens of evidently another species of this genus, which are described below; and there are two males of different species apparently from Brisbane and Mackay in the Brit. Mus Coll. which I do not propose to describe.

The species are distinguished in the females by the club-shaped *palpi* and by the broad concave *forehead*, in the males by the very hairy *face, palpi,* and *antennæ*, in both by the rather flat *abdomen* and large *wings*. *Ocelli* large and distinct. Spines on hind tibiæ *Antennæ* with at least eight divisions on the third joint, having a short first joint, the second one only half its length, the third very slender, composed of a small almost square first division, the following ones very small and narrower. The females may be distinguished by the smaller club-shaped palpi and by the face, which is very much produced under the antennæ, almost reaching the upper border of the first antennal joint.

The genus is allied to *Ectenopsis* in the shape of the forehead in the female; but is at once distinguished from it by the very much larger palpi, and in the male by the larger first antennal joint, which with the second joint is very much more hairy.

Demoplatus trichocerus, ♂ ♀, Bigot, Mém. Soc. Zool. de France, v. p. 616 (1892) [*Corizoneura*].

Type (female) from Herberton, Queensland (*Dodd*), in the German Ent. Museum, and another female in the same collection from Kuranda, Queensland.

Type (male) from Australia in the Verrall Coll. and two other males from Kuranda and Herberton in German Ent. Museum.

A reddish-brown species, with the cross-veins of the pale brown wings shaded dark brown. Legs honey-yellow or reddish yellow.

Length, females 12–13 mm., males 12–13 mm.; proboscis hardly more than 1 mm.

Female.—*Face* Sudan-brown, very short, tuberculous in centre, some black bristly hairs on the outer borders, in the groove dividing the face from the cheeks. Beard consists of fairly long fine brownish-black hairs. Proboscis short. *Palpi* large, almost as long as proboscis, the first joint short, the second long, club-shaped, with black hairs, thick towards their apices, in colour similar to the face. *Antennæ* somewhat paler and more yellow, the first two joints with long black hairs, the third with short ones on every division on outer side, the last divisions dusky in colour. *Forehead* very wide and concave, the most striking characteristic of the genus, same colour as face, with a very few black hairs, slightly narrower at the vertex. Ocelli large and distinct. *Eyes* bare. *Thorax* and *abdomen* Sudan-brown, the abdomen rather darker. *Thorax* with a round waxy-yellow spot on its anterior angles, covered with some reddish-yellow tomentum and a very few black hairs; traces of rufous-coloured hairs on the posterior border. *Scutellum* more yellow in colour. *Abdomen* flat, with some appressed reddish-yellow pubescence. *Legs* antique-brown, some long black hairs on coxæ and femora, elsewhere chiefly reddish yellow. *Wings* large, longer than the abdomen, pale brown, tinged yellow on the fore border; all cross-veins shaded; appendix, if present, short; all posterior cells widely open.

Male identical in colour. *Face* not tuberculous nor very short, long brownish-black hairs below antennæ on centre, covered with greyish tomentum. Beard composed of sparse white hairs. *Palpi* slender, cylindrical, the first joint short, the second long, with dense short pubescence, reddish yellow, not so long as the proboscis. The frontal triangle is very small, the *eyes* joining almost their whole length. Ocelli large, on a protuberant tubercle. *Wings* with the appendix more marked than in females. Genital organs prominent beyond the sixth segment.

Demoplatus australis, ♂, sp. n.

Male (type) from Katoomba, Blue Mts., 3100 ft., New South Wales (*Dodd*), 1912, and another, both in German Ent. Museum; also another male from the same place in Mr. Wainwright's Coll

A dark-coloured species, with brownish wings, darkest on the fore border. Legs and antennæ reddish yellow.

Length 12 mm.; proboscis 1½ mm.

Face brownish, with greyish-yellow tomentum, somewhat produced below the antennæ, forming a large tubercle covered with long black hairs, which are also present on the cheeks. Beard silver-white. *Palpi* a little more than half the length of the proboscis, reddish-yellow, the first joint covered with grey tomentum; pubescence on the second joint consists of short black hairs on the upper and lower sides and of longer ones on the first joint, which is short, stout; the second joint long, cylindrical. *Antennæ* situated on a slightly raised tubercle, the same colour as palpi, dusky at apex, the first two joints with long black hairs, the third with only a few short black ones on apical joints; the third joint has the first division small, ring-like, the second larger, almost square, the remaining narrower and small. Frontal triangle small. *Eyes* bare; ocelli large. *Thorax* blackish, but covered with olive-coloured tomentum and with fairly thick pale fulvous hairs; sides with the same hairs; breast with white hairs. *Scutellum* identical, the hairs on posterior border white. *Abdomen* narrow, flat, the genital organs protruding, reddish, the abdomen itself blackish, with very narrow reddish segmentations on some of the segments; pubescence apparently sparse, consisting of long white hairs on the posterior borders of segments; underside more reddish in colour, with white pubescence. *Legs* much the same colour as the antennæ, Mars-yellow; coxæ blackish, with olive-coloured tomentum and long white hairs; pubescence on femora reddish, with long white hairs on underside, on tibiæ and tarsi chiefly black. *Wings* large, longer than abdomen, the brown colour most intense on the anterior half, fading away on the posterior border; veins brown, small appendix present, all posterior cells widely open.

Mr. Marshall gives me the following additional localities for this species, the collectors being Dr. J. Burton Cleland and Dr. E. W. Ferguson:—2 ♂, Milson Island, Hawkesbury River, 31. iii. 15, 11. iv. 15. Taken resting on bracken. Eyes of a rather dull coppery red.

PSEUDOTABANUS, gen. nov.

Formed for two species from Queensland.

Ocelli and spurs on hind tibiæ present. *Antennæ* with eight divisions on the third joint, which is broad and *Tabanus*-like at the base, with the three divisions after the first basal one indistinct; the last four divisions small and distinct, the first joint very short, hardly more than half the length of the first four divisions of the third joint; the second smaller, cup-shaped. *Palpi* two-thirds the length of the proboscis, *Tabanus*-like. *Wings* with all posterior cells open; no appendix.

The species resemble in general appearance species of the genus *Tabanus.* Proboscis short.

Pseudotabanus distinctus, sp. n.

Type (female) in Brit. Mus. Coll. from Inkermann, near Townsville, N. Queensland (*W. Stalker*), 1908, 151.

Black; the abdomen with yellowish bands. Antennæ and legs black. Wings grey, tinged deep brown on the fore-border and more widely so at the apex on the submarginal cell.

Length 14 mm.; proboscis 2 mm.

Face covered with grey tomentum and with some silvery-white short hairs in the centre and on the cheeks. Beard same colour. *Palpi* rather long, two-thirds the length of proboscis, blackish, a little stout at base, ending in a long point. *Antennæ* same colour, the third joint with an angle at base on its first division, the first two joints with a few dark hairs. *Forehead* more yellowish in colour than the face, parallel, about five times as long as it is broad; the frontal callus long, almost lineal, slightly enlarged anteriorly, reaching the ocelli. *Eyes* bare. *Thorax* black, with two lineal grey tomentose stripes, posteriorly, with a narrow grey border which extends up the sides as far as the suture. Shoulders above this latter are yellowish. Breast and sides blackish, with grey tomentum and white hairs. *Scutellum* black, with a few white hairs. *Abdomen* blackish brown, the posterior borders of all segments brownish yellow fading into grey; there is also a narrow band on anterior border of second segment; the bands are widest on the first two segments; pubescence on bands yellowish white, elsewhere black; underside same as dorsum. *Legs* wholly blackish brown. *Wings* with no appendix, fore border narrowly yellow as far as the stigma, which is brown.

Pseudotabanus queenslandi, sp. n.

Type (female) from Kuranda, Queensland (*F. P. Dodd*), 1914, 381, in Brit. Mus Coll.

Another female from Endeavour River, Queensland, in Mr. French's Coll.

A blackish species, with median grey spots and bands on abdomen.

Length 14½ mm.

Face covered with ashy-grey tomentum, convex in the centre, divided from the cheeks by a deep furrow; pubescence on face scanty, consisting of a few short white or yellow hairs. Beard white. *Palpi* same shape as those of *Pseudotabanus distinctus*, black, two-thirds the length of the proboscis. *Antennæ* black, the first two joints with black hairs; the third joint in type is imperfect; in the other female the basal divisions are fairly distinct, the basal division broad, forming a slight angle. *Eyes* bare. *Forehead* parallel, same colour as face, about five times as long as it is broad; the frontal callus blackish, very narrow, continued nearly to the vertex, ending in a fine point. Ocelli distinct. *Thorax* blackish, with two distinct grey tomentose broad stripes, with appressed white and fulvous pubescence, longer at sides and on posterior border. *Scutellum* covered with grey tomentum, leaving a dark brown spot in the middle, with fairly long white pubescence. *Abdomen* blackish, the median spots triangular, large on the second, third, and fourth segments, their apices not quite reaching the anterior borders; a narrow band of white hairs is continued from each spot to the side, where it broadens out into a wider spot continued up the side of segment; sides with long white hairs; pubescence on the grey spots white, elsewhere black; underside with white-haired bands, matching those on the dorsum. *Legs* black, the pubescence on the coxæ and underside of femora white, elsewhere black. *Wings* clear, tinged faintly with brown on the fore border, more widely so towards the apex; veins yellowish brown.

The species bears a great resemblance in the shape of the frontal callus and forehead and in the markings of the wings to *Pseudotabanus distinctus.*

PSEUDOPANGONIA, gen. nov.

This genus is very distinct from any other genus known to me in the Pangoninæ in its general appearance and in the form of the antennæ, which have three joints as usual, but the third joint has only four divisions.

Antennæ are small, situated on a rather protuberant tubercle; the first two joints short and stout, the second shorter than the first; the third twice as long, composed of four divisions, the first one being stout, conical, the remaining three very narrow, each about the length of the basal joint. *Palpi* are small and narrow. Proboscis short. *Face* short, nearly horizontal, *Forehead* narrow and furrowed. Ocelli prominent on vertex. *Abdomen* large and flat. Pubescence very scanty. Hind tibiæ with one stout spine. *Wings* large, longer than the abdomen; all cells except the anal one widely open; no appendix.

Pseudopangonia australis, sp. n.

Type (female) from Burpengary, S. Queensland (*Dr. T. L. Bancroft*), 1904, 93, in Brit. Mus Coll.; and another female from Richmond River, New South Wales, in Mr. Froggatt's Coll.

A curious-looking humpbacked large fly; the thorax a pinkish buff, the abdomen ochraceous tawny, with a brownish median stripe and apex. Wings tinged brown.

Length 20–23 mm.; proboscis 1 mm.

Face tawny, covered with grey tomentum, devoid of hairs. Beard white. *Palpi* reddish yellow, with black hairs, two-thirds the length of proboscis. *Antennæ* situated on a slightly elevated tubercle, dull reddish yellow; the first two joints with black hairs, the third with a few at sides of small joints and at apex. *Forehead* same colour as face, with a furrow on each side and no defined frontal callus, parallel, about six times as long as it is broad. *Thorax* large, with buff-coloured hairs on dorsum and at sides; breast covered with grey tomentum and with white and brown hairs. *Scutellum* same as thorax. *Abdomen* with a brown median stripe and brown at sides, the last four segments brownish with grey tomentum; pubescence short, not noticeable, chiefly pale or yellow on the yellowish parts and brown elsewhere; underside brownish covered with grey tomentum. *Legs* reddish brown, with black pubescence. *Wings* longer than body, large, tinged brown, chiefly on the fore border; veins yellowish; stigma not distinct; no appendix; all posterior cells widely open.

TABANINÆ.

TABANUS, Linn.

Group XI.

Species with pubescence on the eyes (*Therioplectes*).

This group appears to be very well represented in this region, and is a very difficult one as regards the separation of nearly allied species, especially those in the group containing *Tabanus circumdatus* and *Tabanus antecedens*, Walker. Mr. Arthur White has kindly allowed me to examine his specimens of this group from Tasmania, some of which appear to be new species, and he has a good series of *Tabanus gentilis*, Erichson.

The following species I have not been able to identify:—

Tabanus nigriventris, Macq., from Sydney Island, the type of which is apparently lost, probably belongs to this group, as the author speaks of the eyes being tomentose.

Tabanus brevivitta, ♂, Walker; this type is not to be found in the Brit. Mus. Coll., and should be deleted from the list.

Tabanus macrophthalmus, ♂, Schiner.

Tabanus gregarius and *Tabanus esculans*, Erichson, both from Tasmania, cannot be identified from the descriptions; they may be synonyms of *Tabanus circumdatus*, Walker.

Tabanus bifasciatus, Macq. Hist. Nat. Dipt. i. p. 201 (1834), is not known to me; the type is apparently lost. It is described as having the first posterior cell of the wing closed, a characteristic not met with in any of the described species of *Tabanus* from this region, which inclines one to think it might be a species of the Pangoninæ division. It is described as black, with small white indistinct spots on the abdomen. Wings brownish, the veins shaded, the centre of the cells nearly hyaline.

Length 20 mm. (10 lines).

No mention is made of the eyes, which are probably bare.

Tabanus microdonta, ♀, Macq. Dipt. Exot., Suppl. ii. p. 33 (1846).

Type (female) from Tasmania, and another female from New Holland (M. Serville Coll.).

This type in the late Mr. Verrall's Coll. is in fair preservation, as is the other female; they are distinguished by the frontal callus, which is large, with no lineal extension, but extends as a broad stripe nearly three-quarters of the length of the forehead, ending in an obtuse point. There is also no appendix present on the wings in either female. A blackish species, with some reddish colour on the abdomen.

Length 13–15 mm.

Face covered with brownish-grey tomentum and with brown hairs. Beard brown, a few white hairs below. *Palpi* small and not very stout, about the same width throughout, ending in a short point, dirty yellow in colour, with rather numerous black hairs. *Antennæ* blackish, but the first two joints and the base of third reddish; the latter has hardly any angle representing a tooth on its upper side, the first two joints with black hairs. *Forehead* same colour as face, parallel, about five times as long as it is broad; the frontal callus is pitchy brown in colour, furrowed in the centre, not reaching the eyes; black hairs at sides of forehead. *Eyes* distinctly pubescent. *Thorax* blackish. *Abdomen* blackish, the sides of the first three segments tawny, the segmentations narrowly pale; underside tawny. *Legs* dull reddish, duskier at tips. *Wings* clear, veins brown, stigma yellowish brown.

Tabanus regis georgii, Macq. Dipt. Exot. i. p. 132 (1838).

The type (female) from Port du Roi George, New Holland, was seen by me in the Paris Museum a few years ago, in bad preservation; however, I identified four females in the Brit. Mus. Coll. as this species, and feel confident they are this species, which may possibly be identical with *Tabanus postponens*, Walker; the only difference in these from the Walker type is the shape of the frontal callus, which is much broader, though not reaching the eyes, with hardly any lineal extension in three of the specimens; the colour is a dark brown, the femora are rather dusky at their base. The stripes on the thorax are more distinct and appear as six in number, the specimens being in good preservation. They come from Inkerman, near Townsville, N. Queensland (*W. Stalker*), 1908, 151, and S. Queensland (*Dr. T. L. Bancroft*), 1908, 72.

Tabanus oculatus, ♀, Ricardo.

Tabanus pusillus, Macq. Dipt. Exot., Suppl. v. p. 49 (1854), nomen bis lectum.

Type (female) in the late Mr. Verrall's Coll. from Sydney, New South Wales.

Two females in Brit. Mus. Coll. from S. Queensland (*Dr. T. L. Bancroft*), 1908.

The type, which is in bad preservation, was described by Macquart as having the eyes naked, evidently an oversight on his part, as the pubescence on the eyes of the type is distinct, though very sparse and very indistinct in one of the fresh females. It is very similar in general appearance to my new species *Tabanus germanicus* from N. Australia, in which the eyes are quite bare.

A small brown species, with inconspicuous yellow hairs on the abdomen; the antennæ and legs reddish yellow. Wings clear, with an appendix.

Length 11 mm.

Face covered with grey tomentum, ground-colour yellowish;

hairs on face white. *Palpi* cream-coloured, slender, ending in a long point; pubescence chiefly white, a few black hairs on upper border. *Antennæ* reddish, the first two joints yellower with black pubescence, the third rather short, broad at base, with very slight tooth. Subcallus yellowish, covered with grey tomentum. *Forehead* broad, parallel, about three times as long as it is broad anteriorly, covered with brownish-yellow tomentum and with some few black hairs. Frontal callus shining chestnut-colour, pear-shaped, not reaching the eyes, with a short lineal extension. *Eyes* with slight pubescence. *Thorax* olivaceous black, covered with some grey tomentum and with recumbent, short, golden, inconspicuous pubescence; the longer hairs at sides brownish. *Scutellum* identical. *Abdomen* darker than thorax, covered with isabella-coloured tomentum, and with short golden hairs on the posterior borders of segments, the first two segments reddish at the sides; underside lighter in colour, covered with greyish tomentum. *Legs* cinnamon-coloured, the femora darker, with grey tomentum and white hairs; pubescence otherwise chiefly black, apical tarsal joints blackish. *Wings* clear, stigma pale yellow, veins darker, appendix present.

Mr. Marshall gives me the following additional localities, the collectors being Dr. J. Burton Cleland and Dr. E. W. Ferguson :—four females, i & ii. 1915; one female, 5. xii. 14, Milson Island, Hawkesbury River; one female, Sydney, 20. xii. 14. Eyes of a dull brown colour in life.

Tabanus vetustus, ♀, Walker, List Dipt. i. p. 179 (1848).

Type (female) from Swan River, West Australia.

Another female from Encounter Bay, S. Australia, 1907 (*Dr. J. B. Cleland*), with the following note:—"Bites severely"; and another female from unknown locality.

A medium-sized pale-coloured species, not unlike the European *Tabanus fulvus* in general appearance. Forehead with no callus. Tibiæ reddish yellow. Abdomen covered with short grey pubescence.

Length 15 mm.

Face covered with ashy-grey tomentum and with some short white pubescence. *Palpi* pale chamois-coloured, stout for more than half their length, ending in a slender point, pubescence scanty, pale-coloured. *Antennæ* reddish yellow, the last four divisions of the third joint black; third joint wide at base, with the angle representing the tooth not quite halfway up on the outer border, the first two joints paler in colour, with a few black hairs only. *Forehead* parallel, about four times as long as it is broad; when denuded a dark callus appears, but in the type there is hardly a trace of one. *Eyes* hairy. *Thorax* blackish, covered with fulvous or grey pubescence. *Scutellum* identical. *Abdomen* with a blackish ground-colour, covered with greyish tomentum and with short yellowish-grey pubescence, and some longer black hairs interspersed; the posterior borders of segments reddish yellow, and the first two segments the same colour at the sides; underside very similar. *Legs* reddish yellow; coxæ black, covered with grey tomentum and with white hairs; femora blackish, reddish yellow at extreme base and at apex, covered with grey tomentum and white hairs; pubescence elsewhere yellowish, with some few black hairs. *Wings* clear, veins yellow, appendix present.

Three females from Bellerive, Tasmania, Feb. 13, 1914, in Mr. White's Coll., are identical, but the third joint of antennæ is wholly black.

Tabanus imperfectus, ♀, Walker, List Dipt. i. p. 179 (1848).

Type (female) from New South Wales, and two females from Mangalore, Tasmania; presented by Mr. Arthur White.

A blackish species, smaller than *Tabanus antecedens*, Walker, and the frontal callus is very much larger, taking up the whole of the anterior half of the forehead, with no lineal extension.

Length of type 10 mm.; the other females are somewhat smaller.

Face covered with grey tomentum and with long white hairs, some black hairs intermixed. *Palpi* pale dull yellow, very hairy, a little stout at base, with long black hairs above and white ones below. *Antennæ* in type destroyed, in the other females they are blackish; the first two joints with some black hairs, the third with a small angle to represent the tooth. *Eyes* hairy. *Forehead* broader anteriorly than at the vertex, about a third as wide (anteriorly) as it is long. Frontal callus reddish brown, extending from eye to eye and reaching more than halfway down the forehead; at its posterior end it becomes narrower, ending in a very obtuse point; some black hairs are present on sides of forehead, which is covered posteriorly with grey tomentum. *Thorax* black; in the fresh specimens two narrow grey stripes are apparent, very short, not reaching the median suture; shoulders and the sides greyish, pubescence short, black, longer on shoulders; the posterior borders of thorax appear grey tomentose. *Scutellum* blackish, with traces of white hairs on its borders. *Abdomen* blackish, all the segmentations grey tomentose, with white hairs; traces of white median spots appear on the type and are distinct in the fresh specimens on the second, third, and fourth segments; pubescence elsewhere on dorsum black; sides of the first two segments are inclined to be reddish in colour. *Legs* blackish, femora with grey tomentum, the tibiæ yellowish, as is also the first joint of the tarsi; pubescence black, with long and short hairs on the sides of the tibiæ. *Wings* clear, an appendix present, veins and stigma blackish.

Tabanus antecedens, ♀, Walker, List Dipt. i. p. 178 (1848); ♂, List Dipt. v. p. 253 (1854).

Type (female) from Van Diemen's Land, and a series of females from Mts. of Victoria (*C. French*), 1900; one from Tasmania, presented by Mr. A. White; and others from Dandenong Ranges, Victoria (French Coll.).

A blackish species larger than *Tabanus imperfectus*, Wlk., with pale slender palpi, a hairy face, dark antennæ, and forehead parallel or almost so, with a large square frontal callus. Abdomen with grey segmentations and often indistinct, grey-haired, triangular median spots.

Length 12–13 mm.

Face covered with ashy-grey tomentum and with black hairs, with which are intermixed a few shorter white hairs; lower part of face pale reddish. *Palpi* pale reddish yellow, covered with grey tomentum on basal half and with rather long black hairs, intermixed with white hairs on basal half, which is stout, the apical half slender, ending in a point. Beard composed chiefly of white hairs. *Antennæ* blackish, the first two reddish yellow with black hairs, the third rather broad at base, with a distinct angle representing the tooth. *Forehead* parallel or slightly narrower at the vertex, the subcallus usually covered with greyish tomentum, often denuded and appearing reddish; the frontal callus is large, reaching the eyes, almost square, shining reddish brown or black, with a short extension; some rather long black pubescence is present on the forehead, which is covered with greyish tomentum; at the vertex a tuft of long black hairs is a characteristic of this species. *Eyes* with thick pubescence. *Thorax* blackish, with four lineal slaty-grey tomentose stripes, not always very distinct; shoulders pale reddish; pubescence on thorax long, black, with some interspersed pale short hairs. *Scutellum* blackish, with a slaty-grey outer border. *Abdomen* brownish black, with grey tomentum, becoming slate-grey on the segmentations; pubescence consists of rather close short black hairs; in a few specimens from Victoria the abdomen is large, reddish brown, instead of brownish black, in the type and in others the extreme posterior lateral borders of the fifth, sixth, and seventh segments are reddish; underside very similar to dorsum, but almost bare. *Legs* blackish, the tibiæ reddish, becoming blackish at the apex on the fore tibiæ; pubescence black, on the outer borders of the tibiæ the hairs are uneven in length. *Wings* clear, with blackish veins, stigma yellowish, appendix present.

Mr. White informs me that this is the commonest species in Tasmania.

The male type of *Tabanus antecedens* comes from New Holland (*Hunter*), and the antennæ are imperfect; whether it is really the male of the above is doubtful.

Tabanus circumdatus, ♀, Walker, List Dipt. i. p. 185 (1848).

Tabanus nepos, ♀, Walker, List Dipt. i. p. 181 (1848).
Tabanus abstersus, ♀, Walker, Dipt. Saund. p. 58 (1850).
Tabanus brevidentatus, ♀, Macq. Dipt. Exot., Suppl. v. p. 28 (1854).
Tabanus hebes, ♀, Walker, List Dipt. i. p. 159 (1848); Surcouf et Ricardo, Étude Monographique des Tabanides d'Afrique, p. 214 (1909).

The type of *circumdatus* and *nepos* are from unknown localities, but priority is given to the former, as it is a better-preserved more typical specimen of the species; *hebes* was erroneously described as from S. Africa, *abstersus* is from New South Wales (Saunders Coll.), *brevidentatus* from Australia.

The type of *hebes* and two other females are very reddish and paler in colouring than is usual, but this is probably chiefly accounted for by the denudation and bad preservation of the specimens; these remarks also apply to *nepos*.

This is probably the species mentioned by Mr. Froggatt in "March Flies" (Science Bulletin, no. 3, Sept. 1911, p. 6) as *Tabanus brevidentatus*, "the common small greyish-brown March fly found in the scrub or bush around Sydney." The types of the Macquart species are in the late Mr. Verrall's Coll.

There are specimens in the Brit. Mus. Coll. from Eidsvoll and Burnett River, Queensland (*Dr. T. L. Bancroft*); New South Wales (Saunders Coll.); National Park, New South

Wales; and Cleveland, Tasmania (*Dr. J. L. Purdy*); with the following note attached to this last specimen:—

"March Flies. Very common in Tasmania, especially in sheep districts in the Midlands. Bite sharp, like the prick of a pin, and especially severe on children, causing swelling and slight inflammation. Nuisance has recently become so severe as to interfere with school discipline. The least touch kills the flies, and after school occasionally a shovelful can be swept up"—Note by Dr. J. S. Purdy, Chief Health Officer, Hobart.

Tabanus edentulus, Macq., is possibly identical or very nearly related to this species. *Tabanus acutipalpis*, Macq., appears very similar, but is larger in size. Both types are in the Paris Museum. *Tabanus fraterculus*, Macq., is said by the author to be related to *T. edentulus* (the type is lost) from Tasmania. A rather variable species in colouring, it may be distinguished from *Tabanus imperfectus* and *Tabanus antecedens* by its larger size and more reddish colour of the abdomen. The forehead is very slightly broader anteriorly than it is at the vertex, contrary to the usual rule.

Length 13–15 mm.

Face covered with greyish tomentum and with short white hairs, a few brown ones usually present on the centre. Beard white, a few brown hairs intermixed. *Palpi* yellowish, long and slender, stouter on basal half, ending in a long point, very hairy; the basal half with some grey tomentum and with white hairs, on the apical half they are short and black. *Antennæ* reddish, the third joint dusky, the first two joints with black hairs, the third joint wholly dusky or dull reddish at base; it is rather broad at the base with a small tooth. *Forehead* and subcallus with grey tomentum, the latter often much denuded, appearing reddish or brown; the frontal callus almost square, reaching the eyes, with a lineal extension, usually reddish brown or reddish yellow. *Eyes* distinctly pubescent in fresh specimens. *Thorax* and *scutellum* blackish with grey tomentum and yellowish recumbent pubescence, intermixed with longer grey hairs on anterior part of thorax, and posteriorly and on outer border of scutellum; in denuded specimens two narrow grey stripes appear; shoulders and sides reddish. *Abdomen* dull reddish yellow with grey tomentose segmentations and small median triangular grey spots; in many specimens, especially those from Queensland, the colour is more reddish brown; pubescence short, black, with white hairs on the segmentations and at sides below black hairs; underside reddish yellow, nearly bare, with very short white hairs on the segmentations. *Legs* blackish, the femora with grey tomentum; the tibiæ reddish; pubescence black, femora with some long white hairs, and the tibiæ, especially the middle pair, with some short white hairs. *Wings* clear, appendix present, veins reddish yellow; stigma very indistinct, pale yellow.

The male I have not been able to identify with certainty.

Tabanus postponens, ♀, Walker, List Dipt. i. p. 179 (1848).

Type (female) from New Holland.

A small species with reddish-yellow antennæ and legs, a broad forehead, widest anteriorly with a small oblong frontal callus. Abdomen reddish brown with wide grey tomentose bands and median spots.

Length 12 mm.

Face covered with yellowish-grey tomentum, a few dark hairs in centre. Beard yellowish white. *Palpi* pale orange-yellow, slender, stout on more than half their length, ending in a long fine point, with rather thick short white pubescence. *Antennæ* Mars-yellow, the first two divisions with some black hairs, the third division incomplete, stout at base with an indistinct tooth. Subcallus same colour as antennæ, shining, but probably from denudation of greyish tomentum. *Forehead* a little wider anteriorly than at vertex, covered with grey tomentum, about three times as long as it is broad anteriorly; frontal callus small, oblong, not reaching eyes, chestnut-brown, with a short lineal extension. *Eyes* distinctly hairy. *Thorax* blackish brown covered with greyish tomentum which leaves three dark stripes visible, some pale fulvous appressed pubescence on dorsum and some longer dark hairs at sides. *Scutellum* same colour. *Abdomen* reddish brown, the grey tomentose bands are present on every segment except the last one, about half the width of the segment, extending in the middle to an obtuse trianglar spot, largest on the second, third, and fourth segments, pubescence on these bands yellowish. *Legs* Mars-yellow, dusky on apices of tarsal joints, pubescence on femora white, elsewhere black. *Wings* clear, veins and stigma yellowish brown; small appendix present.

Tabanus basalis, ♀, Walker, List Dipt. i. p. 182 (1848).

Type (female) from New Holland, and another female from Tamworth, New S. Wales, 12. 12. 92, from Froggatt Coll.

A small reddish-yellow species with a dull yellowish-grey abdominal median stripe on a black ground-colour. Antennæ and legs reddish yellow. Forehead broader anteriorly.

Length 9½ mm., other female 10½.

Face covered with greyish tomentum and with some brown and white hairs. Beard white. *Palpi* chamois-coloured, hairy, slender, only slightly stouter on basal half, ending in a point; pubescence yellowish white at base. *Antennæ* Mars-yellow, the first two joints with black hairs, the third joint with very small angle representing tooth at base. *Forehead* covered with greyish tomentum, distinctly broader anteriorly, barely three times as long as it is broad anteriorly; frontal callus large, nearly square, not reaching the eyes, with a short thick extension. *Eyes* very slightly pubescent. *Thorax* blackish with grey tomentum, shoulders reddish, dorsum with some appressed fulvous hairs. *Scutellum* identical. *Abdomen* ochraceous-orange; ground-colour of median stripe and the last segments black, the pale colour covered with some grey tomentum; the median spots forming a short nearly continuous stripe from the second to the sixth segment, large, triangular-shaped, hardly apparent in type owing to denudation; underside wholly pale in colour. *Legs* Mars-yellow, tarsi dusky-coloured; pubescence on femora white, elsewhere black; femora with greyish tomentum. *Wings* clear, veins pale brown, stigma yellowish; appendix present.

Tabanus umbripennis, ♀, Ricardo.

Tabanus cinereus, Walker, List Dipt. i. p 167 (1848), nomen bis lectum.

Type (female) from W. Australia

A black species covered with grey tomentum. Antennæ, palpi, and legs blackish. Recognised at once by the wings, which have the cross-veins and longitudinal ones shaded with brown.

Length 16 mm.

Face blackish covered with grey tomentum and with some short white hairs. Beard chiefly brown, some white hairs below. *Palpi* appear blackish covered with dense grey tomentum and with short black pubescence, on the inside they are reddish yellow. *Antennæ* black, stout, the first two joints with short black hairs, the third broad at base with a distinct tooth, apical joints are broken off. *Forehead* very broad, parallel, barely three times as long as it is broad, black covered with grey tomentum; frontal callus pitchy brown, pear-shaped, with short lineal extension. *Eyes* with traces of pubescence. *Thorax* black, with some grey tomentum on dorsum; shoulders obscurely reddish with long dark pubescence. *Scutellum* same colour. *Abdomen* similar in colouring, the grey tomentum thick, especially at base; there are traces of white pubescence on the segmentations laterally, with black hairs at apex and on the sides. *Legs* with dark pubescence. *Wings* grey, on fore border yellowish brown, at base pale brown; all the veins shaded with dark brown, which appears as blotches round all the cross-veins; stigma brown, veins brown; appendix present.

Judging from the figure of the wing of *Tabanus funebris*, Macq., this is a different species.

Tabanus dubiosa, ♀, sp. n.

Type, a female, and another from Burnett River District, Queensland (*Dr. T. L. Bancroft*), 1912, 212. One female from Katoomba, Blue Mts., New S. Wales, in Mr. Wainwright's Coll.

A small black species with well-marked grey spots and segmentations on abdomen. Antennæ, palpi, and legs black.

Length 13 mm.

Face covered with greyish tomentum and with some brown hairs, among which are a few white ones. Beard white. *Palpi* black, some grey tomentum on the basal half, which is stout, ending rather abruptly in a long point; pubescence black, a few white hairs on basal half. Antennæ dusky brown, a dull reddish brown on the basal division of the third joint; pubescence on the first two joints black, the tooth of third only represented by an angle. *Forehead* broader anteriorly than at vertex, about three times as long as it is broad, covered with greyish tomentum; the frontal callus blackish, shining, large, almost reaching the eyes, oblong, the lineal extension ending in a point. *Thorax* blackish covered with grey tomentum, and with short dense grey pubescence, so disposed that the black ground-work appears as stripes, sides with white hairs; shoulders reddish with brown hairs, pubescence on breast grey. *Scutellum* blackish with long white hairs on posterior border. Abdomen black, the posterior border of each segment except the first one with a narrow grey tomentose band, extended in the middle as a median spot; the black pubescence on dorsum short and dense, on the bands white; underside similar, but no median spots are visible. *Legs* black, knees reddish ; the coxæ covered with grey tomentum and with long white hairs ; pubescence elsewhere black. *Wings* clear, stigma very pale yellow, veins brown ; short appendix present.

Tabanus froggatti, sp. n.

Type (female) from south coast, New South Wales, 5. 3. 1910, in Mr. Froggatt's Coll.

A black species with very narrow pale segmentations and some median spots on abdomen, distinguished by the greater narrowness of the forehead at the vertex than anteriorly, as is usual, and by the long hairs on face and palpi. Wings shaded on the cross-veins.

Length 13 mm.

Face covered with grey tomentum and with long black hairs in the centre and on cheeks at sides ; a few long white hairs appear on the foveæ and continue round the base of face above the beard, which is black with a few white hairs intermixed below. *Palpi* dull reddish yellow, clothed with long black hairs, thickest and longest at the base, which is a little stout, the palpus ending in a long point, so that the palpi are long and slender. *Antennæ* black, the first joint cylindrical, the second round, not half the length of the first; both with some grey tomentum, and with long black hairs ; the third joint short with no distinct tooth, the first division broad, once and a half longer than the last divisions, which are very narrow. Subcallus shining brown, but covered with ashy-grey tomentum almost entirely. *Forehead* twice as wide anteriorly as it is at vertex ; the frontal callus shining brown as the subcallus, taking up the whole width of forehead and furnished with a short stout extension, the remainder of the forehead covered with yellowish-grey tomentum and with long black pubescence ; vertex and hind part of head with similar pubescence. *Eyes* thickly covered with pale hairs. *Thorax* shining black, with some short, white, appressed pubescence and long black hairs at shoulders and on sides. *Scutellum* similar. *Abdomen* shining blackish brown, the segmentations very narrowly grey tomentose and with short white pubescence ; a grey tomentose median spot is visible on the second segment and a smaller one on the third, dorsum with black pubescence and some yellowish-grey tomentum ; underside more chocolate-brown, and devoid of pubescence. *Legs* blackish, the knees and basal third of fore tibiæ yellowish red, the knees and two-thirds of the middle tibiæ the same colour; pubescence on legs black; fore coxæ covered with yellowish-grey tomentum and with long black hairs. *Wings* clear, the veins brown, the cross-veins all shaded narrowly with brown, stigma yellowish brown; appendix present.

Tabanus gentilis, Erichson, Archiv. f. Naturgesch. viii. p. 271 (1842).

This species by reason of its spotted wings is more easily identified than the other two species by the same author, and has been found by Mr. Arthur White in Tasmania, who has kindly given a specimen to the Brit. Mus. Coll.

My new species, *Tabanus froggatti*, is nearly related to *T. gentilis*, both species having the same-shaped forehead, quite a distinctive feature in them. This species is distinguished from my species by its reddish antennæ and legs; the palpi are also lighter in colour, and the hairs on the face and the beard are more largely white than black. The chief difference is in the wings, which in this species are more distinctly spotted, all the cross-veins on the upper part of wing having dark spots round them.

XXXIII.—*Notes on Fossorial Hymenoptera.*—XVII. *On new Ethiopian Species.* By Rowland E. Turner, F.Z.S., F.E.S.

Family Crabronidæ.

Subfamily *Stizinæ*

Sphecius milleri, sp. n.

♀. Nigra; capite, antennis, pronoto, mesonoto lateribus, tegulis, scutello pedibusque ferrugineis: clypeo, segmentoque primo secundoque dorsalibus macula magna utrinque flavis, segmenti secundi maculis strigam nigram transversam includentibus; alis flavo-hyalinis, venis ferrugineis.
Long. 25 mm.

♀. Clypeus with a large, flattened, rather indistinctly margined, subtriangular area in front; eyes converging towards the clypeus, posterior ocelli rather more than twice as far from each other as from the eyes. Antennæ inserted as far from each other as from the eyes, the scape short, about half as long as the second joint of the flagellum, which is half as long again as the third, the flagellum thickened towards the apex. Thorax finely and very closely punctured, clothed with short greyish pubescence; abdomen more sparsely punctured. Hind calcaria broad, blunt at the apex, as long as the second and third joints of the hind tarsus combined. Second abscissa of the radius very short, about one-quarter of the length of the first transverse cubital nervure, and a little shorter than the distance between the two recurrent nervures on the cubitus, the second recurrent nervure received as near to the first as to the apex of the second cubital cell. The abdomen is not much broadened to the base, much less so than in *grandidieri*.

Hab. Ambirisao, N. Rhodesia; October (*F. V. Bruce Miller*).

In the shape and markings of the abdomen this species approaches the S. American *S. spectabilis*, Tasch. The form of the clypeus is near *S. grandidieri*, Sauss., from which it differs much in colour, in the more slender form, in the less dilated hind calcaria, and in details of neuration.

Subfamily *ARPACTINÆ*.

Ammatomus spiniferus, Buyss.

Gorytes spiniferus, Buyss. Ann. Soc. Ent. France, p. 359 (1897). ♀.
Ammatomus africanus, Turn. Ann. & Mag. Nat. Hist. (8) x. p. 371 (1912). ♀.

Arpactus (*Hoplisoides*) *marshalli*, sp. n.

♂. Ferrugineus; mandibulis, clypeo, orbitis internis, scapo subtus, pronoto, scutello dimidio apicali, segmento dorsali primo fascia lata apicali lateribus dilatata, quarto fascia apicali, secundo tertioque fascia angustissima apicali flavis; alis hyalinis, area radiali infuscata, stigmate testaceo, venis nigris.

Long. 9 mm.

♂. Clypeus broad, transverse at the apex, labrum shallowly emarginate in the middle; eyes slightly convergent towards the clypeus, posterior ocelli almost twice as far from each other as from the eyes. Second joint of the flagellum longer than broad, joints 3–10 as broad as long, or broader; a distinct sulcus from the anterior ocellus to the base of the antennæ. Head finely and not very closely punctured, thorax and abdomen with larger punctures, pronotum and first dorsal segment shining and almost smooth, the triangular basal area of the median segment rather coarsely obliquely striate. Mesonotum broad and robust:

median segment short. First abdominal segment gradually broadened from the base; pygidium broadly triangular, without a distinct pygidial area. Anterior tarsi without a comb. Carina of the mesosternum as in *aglaia*, Handl. Cubitus of the hind wing interstitial with the transverse median nervure; second abscissa of the radius as long as the first.

Hab. Chirinda Forest, Gazaland; March 1907 (*G. A. K. Marshall*).

This is a more robust species than *aglaia*, Handl., or *thalia*, Handl. The penultimate joint of the antennæ is slightly excavated beneath, but not as strongly as in *aglaia*. The yellow apical bands on the second and third dorsal segments are extremely narrow, almost obsolete. The thorax is more sparsely punctured than in *aglaia*.

Arpactus nyasicus, sp. n.

♂. Niger; antennis, mesonoto, segmentoque dorsali secundo fascia lata basali ferrugineis; clypeo, mandibulis basi, scapo subtus, orbitis interioribus anguste, pronoto, mesonoto lateribus, fasciisque duabus longitudinalibus, tegulis, mesopleuris antice, scutello fascia apicali, postscutello, segmento mediano fascia lata obliqua utrinque, metapleuris antice, segmento dorsali primo macula basali, fasciaque apicali interrupta et lateribus valde dilatata, segmentis 2–5 fascia lata apicali, sexto omnino, segmento ventrali primo, secundo macula triangulari utrinque, coxis supra, femoribus subtus, tibiisque subtus flavis; femoribus tibiisque supra tarsisque fusco-ferrugineis; alis hyalinis, venis fuscis, stigmate testaceo, cellula radiali valde infuscata.

Long. 11 mm.

♂. Antennæ simple, the second joint of the flagellum longer than the scape, equal to the third joint. Clypeus very slightly convex, the apical margin straight; a distinct groove running from the anterior ocellus to the antennæ. Eyes converging towards the clypeus, but not quite as strongly as in *natalensis*, Sm. The whole insect shining, the punctures microscopic; head and abdomen clothed with a fine silky pubescence; a transverse row of large punctures at the base of the scutellum; four indistinct longitudinal grooves from the anterior margin of the mesonotum; the marginal and median grooves of the smooth basal area of the median segment striated. First abdominal segment slender, distinctly constricted at the apex. Second abscissa of the radius a little longer than the first; second recurrent nervure received a little farther from the apex of the second cubital cell than in *natalensis*. Cubitus of the hind wing originating before the transverse median nervure.

Hab. Nyasaland, S.W. of Lake Chilwa; January 16, 1914 (*S. A. Neave*).

This belongs to the group of *natalensis*, Sm., and *effugiens*, Brauns, but differs much in colour. The mesonotum is marked in front by four shallow grooves instead of low carinæ as in the two species referred to.

Arpactus fugax, sp. n.

♀. Brunneo-ferruginea; fronte, vertice, mesonoto fascia longitudinali, scutello basi, postscutello basi, segmento mediano area basali, mesosternoque nigris; pronoto, scutello postscutelloque fascia apicali, segmento dorsali secundo fascia lata apicali, quarto fascia apicali, quintoque omnino flavis; alis hyalinis, venis fuscis, stigmate testaceo, area radiali valde infuscata.

Long. 13 mm.

♀. Eyes slightly, but not strongly, converging towards the clypeus; second and third joints of the flagellum about equal, longer than the scape; front marked with a distinct longitudinal groove. Mesonotum marked anteriorly with four short and distinct grooves; the transverse, crenulate, groove at the base of the scutellum very strongly marked; the marginal and median grooves of the minutely punctured and pubescent basal area of the median segment marked with distinct striæ. The whole insect very minutely punctured and clothed with very fine pubescence, more sparsely punctured on the head. First abdominal segment slender, gradually widened from the base; pygidial area shining, with a few scattered punctures, triangular, the sides longer than the base. Second abscissa of the radius as long as the first.

Hab. Makindu, British East Africa; December 16, 1911 (*S. L. Hinde*).

This belongs to the *natalensis* group, and seems to be very near *effugiens*, Brauns, but has shallow grooves on the mesonotum, instead of low carinæ, no yellow band on the third dorsal segment, and the eyes can hardly be described as "stark konvergent." In other points the description of *effugiens* agrees fairly well with *fugax*.

The African species of the *natalensis* group (of which Handlirsch gives *kohlii* as the type) may be separated as follows:—

1. Second dorsal segment almost entirely yellow, at most with a triangular black mark on the middle of the apical margin .... *A. natalensis*, Sm.

	Apical half or less of the second dorsal segment yellow	2.
2.	Mesonotum with yellow bands	*A. nyasicus*, Turn.
	Mesonotum without yellow bands	3.
3.	Third dorsal segment with a yellow apical band	*A. effugiens*, Brauns.
	Third dorsal segment without yellow markings.	*A. fugax*, Turn.

Fam. **Bethylidæ.**

The African genera closely allied to *Pristocera* may be divided as follows:—

1.	Apical ventral segment divided from base to apex	2.
	Apical ventral segment not divided, pronotum strongly depressed transversely close to the posterior margin	*Pristocera*, Klug.
2.	Pronotum strongly transversely depressed close to the posterior margin; head unarmed	*Mangesia*, Kieff.
	Pronotum not depressed transversely	3.
3.	Cheeks armed with a strong spine	*Nomineia*, Kieff.
	Cheeks unarmed	*Kathepyris*, Kieff.

These genera are very close to each other, and perhaps would have been better left as one genus till the females are better known. The depressed transverse groove near the apex of the pronotum is common to *Pristocera* and *Mangesia*, but the female of the latter differs from *Pristocera* in the structure of the median segment. The development of the neuration in all the genera seems to vary considerably, also the position of the first recurrent nervure.

In my keys to the species I only include those which I have seen.

Key to the Species of Mangesia.

1.	Head strongly tuberculate at the posterior angles beneath	*M. tuberculata*, Turn.
	Head not tuberculate.	2.
2.	First recurrent nervure well-defined	3.
	First recurrent nervure only faintly indicated	4.
3.	Entirely black, wings dark fusco-hyaline.	*M. brevicornis*, Turn.
	Head and dorsal surface of the thorax red, wings fusco-violaceous	*M. atopogamia*, Turn.
4.	Antennæ orange	*M. subviolacea*, Enderl.
	Antennæ black or fusco-ferruginous	5.
5.	Black, the mandibles only fusco-ferruginous	6.
	Antennæ fusco-ferruginous, four apical abdominal segments ferruginous red	*M. ruficaudata*, Westw.
3.	Space between second and third mandibular teeth much greater than between the others, antennæ slender at apex	*M. communis*, Turn.

Space between second and third mandibular teeth no greater than between the others, antennæ not slender at apex ... *M. atra*, Kieff.

Mangesia subviolacea, Enderl.

Pristocera subviolacea, Enderl. Arch. f. Naturg. p. 211 (1901). ♂.
Mangesia fuscipennis, Kieff. Ann. Soc. Sci. Bruxelles, xxxv. p. 210 (1911). ♂.

Mangesia atopogamia, sp. n.

♂. Niger; capite, pronoto, mesonoto scutelloque rufis; flagello nigro; alis fusco-cæruleis.
Long. 17 mm.

♂. Mandibles very broad, with five strong teeth; clypeus with a distinct median carina; antennæ inserted low down, close to the base of the clypeus, a tubercle above the base of each antenna; the flagellum covered with black pubescence, the first joint as broad as long, the third nearly as long as the first and second combined and fully half as long again as broad, the apical joint longer than the penultimate and about five times as long as broad. Head punctured-rugose, subquadrate, rounded at the posterior angles; eyes separated from the posterior margin of the head by a distance not exceeding their own length; ocelli in a triangle, the posterior pair about four times as far from the eyes as from each other. Thorax coarsely punctured, the pronotum strongly rounded anteriorly; median segment coarsely rugose, with a median longitudinal carina, the surface of the posterior truncation transversely rugose-striate. Abdomen flattened, smooth and shining, the seventh segment very broadly rounded at the apex. Neuration similar to that of *fuscipennis*, Kieff., the type of *Mangesia*; but the extension of the radius is more distinct, and the cubitus is continued beyond the apex of the second cubital cell, though broken by a white scar at the junction of the first transverse cubital nervure.

Hab. S.W. of Lake Chilwa, Nyasaland; January (*S. A. Neave*).

The head is much more quadrate than in *fuscipennis* and less narrowed posteriorly, the petiole is shorter, being broader than long, and only the median carina of the median segment is developed. The tarsal ungues are tridentate, as in Kieffer's figure (Ann. Soc. Sci. Bruxelles, p. 201, 1911). Superficially this species strongly resembles *Elis atopogamia*, Sauss., which occurs in the same locality, the size and colour being the same in both species.

Mangesia incerta, sp. n.

♀. Nigra; mandibulis basi fusco-ferrugineis; tarsis articulis duobus apicalibus brunneo-testaceis.
Long 13·5 mm.

♀. Wingless; mandibles very broad, tridentate, the upper tooth broadly truncate, the outer surface of the broad apical portion of the mandibles striate-rugose. Antennæ thirteen-jointed, the scape strongly arched, the flagellum nearly two and a half times as long as the scape, the two apical joints longer than broad, the others as broad as long or broader. Head subquadrate, slightly rounded at the posterior angles, strongly punctured, the punctures sometimes confluent longitudinally. Ocelli absent, eyes small, ovate, reaching the base of the mandibles. Pronotum about half as broad as the head, a little longer than broad, widened rather abruptly close to the posterior angles, strongly but rather sparsely punctured. Scutellum smooth and shining, triangular; mesopleuræ strongly punctured, showing a dorsal lobe on each side of the scutellum. Median segment longer than the pronotum, narrowed almost to a point at the base, and widely furcate, gradually broadened posteriorly, the apical slope oblique, the dorsal surface smooth and shining at the base, very sparsely punctured at the apex, with a broad, shallow, longitudinal sulcus, the surface of the posterior slope rugulose; sides of the segment almost smooth. Abdomen shining, minutely punctured; the first segment as long as the second and rounded at the base; six dorsal segments. Tarsal ungues simple; intermediate tibiæ strongly spinose; hind tibiæ hairy, but without spines.

Hab. S.W. of Lake Chilwa, Nyasaland; January (*S. A. Neave*).

Although not taken coupled I have no doubt that this is the female of a species of *Mangesia*. It may be distinguished from females of *Pristocera* by the less developed fork at the base of the median segment and by the presence of a sulcus on the dorsal surface of the segment. The abdomen has only six distinct segments, though there is a very small seventh segment, which is probably often withdrawn below the sixth; in *Pristocera* there are eight segments.

Mangesia tuberculata, sp. n.

♂. Niger, albo-pilosus; mandibulis basi fusco-ferrugineis; alis fusco-hyalinis; capite angulis posticis infra tuberculatis.
Long. 14 mm.

♂. Mandibles broad, with five teeth at the apex; the clypeus almost flat, with a very low carina. Head punctured-rugose, the hind angles beneath produced into stout tubercles, somewhat longer than broad, slightly narrowed posteriorly, the eyes separated from the posterior margin of the head by a little more than their own length. Pronotum transversely rugose, arched anteriorly, a little shorter than the mesonotum; mesopleuræ rugose, dorsulum and scutellum coarsely punctured. Median segment rugose, with a narrow longitudinally striated space at the base, three longitudinal carinæ rather near together running from the base to the apex, the space between them transversely striated. Abdomen shining, almost smooth. Tarsal ungues bifid, with a blunt lobe at the base. Neuration as in *subviolacea*. The sides of the median segment are strongly striated.

Hab. Mlanje, Nyasaland; January (*S. A. Neave*).

This species may be distinguished by the tubercles on the head. The tarsal ungues resemble those of *K. nyassica*, but the basal lobe is more strongly developed. The recurrent nervure is received well before the first transverse cubital nervure. The pronotum is distinctly transversely depressed on the posterior margin. The wings are hyaline at the base, a fuscous cloud spreads itself apically from the stigma. The species is near *decemdentata*, Enderl. (Arch. f. Naturg. p. 213, 1901), but in that species the tegulæ and mouthparts are yellow-brown, the five apical joints of the antennæ, although much thinner than the preceding joints in *tuberculata*, are no longer, as is the case in *decemdentata*. The sculpture is also different. Enderlein does not mention the shape of the head in his species, but the shape of the mandibles is very similar. A specimen from Calabar in the British Museum, which I identify as *decemdentata* with some doubt, is only 10 mm. in length and has a much smaller head, rounded at the hind angles and without tubercles, the pronotum is also without a transverse sulcus at the apex; so that if I am right in my identification, *decemdentata* is a *Kathepyris*.

Mangesia brevicornis, sp. n.

♂. Niger, albo-pilosus; alis fusco-violaceis.

Long. 13 mm.

♂. Mandibles tridentate; antennæ stout and short, not more than half as long again as the head, the second joint of the flagellum as long as the first and third combined, joints 4–7 broader than long, the four apical joints very much more slender than the others. Head coarsely punctured, a little longer than broad, rounded at the posterior angles. Pronotum rugose, arched anteriorly, transversely depressed on the posterior margin; mesonotum and mesopleuræ punctured-rugose; scutellum sparsely punctured. Median segment irregularly reticulate, transversely striated towards the apex, three carinæ from the base not reaching beyond the middle. Abdomen shining and almost smooth, the sides thinly covered with white pubescence. Tibiæ thickly covered with white pubescence; the tarsal ungues tridentate, the basal tooth rather blunt Recurrent nervure received before the first transverse cubital nervure, the latter rather indistinct.

Hab. Mlanje, Nyasaland (*S. A. Neave*); February.

This may be distinguished from *atra* by the antennæ, which are very stout at the base, with the four apical joints abruptly narrowed, by the position of the recurrent nervure, and the colour of the wings.

Mangesia communis, sp. n.

♂. Niger; mandibulis fusco-ferrugineis; alis hyalinis, leviter infuscatis, venis nigris.

Long. 13 mm.

♂. Mandibles quadridentate, the second and third teeth much more widely separated from each other than from the other teeth; second joint of the flagellum distinctly longer than the third, the apical joints slender but not elongate. Head coarsely punctured, rather sparsely on the vertex, punctured-rugose on the front, quadrate, the eyes separated from the posterior margin of the head by a little more than their own length. Pronotum transversely rugose, the anterior margin raised, the posterior margin strongly depressed. Mesonotum and scutellum strongly but rather sparsely punctured, the mesopleuræ rather more closely punctured. Median segment irregularly longitudinally striate at the base, with a low median carina reaching the apex of the horizontal surface, the remainder of the horizontal surface very irregularly reticulate, the apical slope almost vertical and transversely striated. Abdomen shining, the sides and apex very finely punctured and clothed with thin white pubescence. Submedian cell closed; cubital, transverse cubital, and recurrent nervures more or less faintly indicated, the first recurrent received before the first transverse cubital, the second recurrent and second transverse cubital indicated by white scars.

Hab. Mlanje, Nyasaland, 6500 ft.; December to February (*S. A. Neave*).

This is rather near *atra*, Kieff., but the mandibles are different, also the position of the first recurrent nervure, which is interstitial in *atra*. In that species the antennæ are stouter, especially at the apex, and the second joint of the flagellum is not longer than the third.

Key to the Species of Kathepyris.

1.	First transverse cubital nervure present; abdomen black	2.
	First transverse cubital nervure obsolete; abdomen light ferruginous	*K. abdominalis*, Turn.
2.	First recurrent nervure interstitial with the first transverse cubital nervure	*K. nyassica*, Kieff.
	First recurrent nervure received before the first transverse cubital nervure	*K. decemdentata*, Enderl.

Kathepyris abdominalis, sp. n.

♂. Niger; mandibulis, antennis, abdomine, tegulis pedibusque rufo-testaceis; alis hyalinis, venis rufo-testaceis.
Long. 7 mm.

♂. Mandibles bidentate; antennæ not stout, 13-jointed, the joints of the flagellum (except the first) longer than broad, the third joint as long as the second. Head coarsely but not very closely punctured, broader than long, the eyes separated from the posterior margin of the head by a distance not exceeding their own length. Pronotum longer than the mesonotum, much narrowed in front, the anterior margin straight, closely punctured; mesonotum and scutellum more sparsely punctured; mesopleuræ finely rugose, with a shining patch below the base of the hind wings. Median segment longer than broad, finely rugose at the base, smoother at the apex, with two low, parallel, longitudinal carinæ. Abdomen smooth and shining. Tarsal ungues bifid. Submedian cell only indistinctly enclosed on the outer and lower margins. The apical ventral segment is divided longitudinally.

Hab. Mt. Kokanjero, S.W. of Elgon, Uganda Protectorate, 6400 ft.; August (*S. A. Neave*).

The cubital, transverse cubital, and recurrent nervures are indicated by faint scars, the transverse cubital being practically obsolete; the first recurrent joins the cubitus before the position of the first transverse cubital.

Genus NOMINEIA, Kieff.

Nomineia, Kieff. Ann. Soc. Ent. France, lxxx. p. 453 (1911).

Type, *N. africana*, Kieff.

This genus may be distinguished by the long spines on the cheeks, but is very close to *Pristocera* and *Kathepyris*.

Key to the Species.

1. Recurrent nervure interstitial with the first transverse cubital nervure, well developed .. *N. spinigera*, Turn.
Recurrent nervure received before the first transverse cubital nervure, indistinct ...... *N. armaticeps*, Turn.

Nomineia spinigera, sp. n.

♂. Nigor, albo-pilosus; alis fusco-hyalinis; genis infra acute tuberculatis, pronoto antico angustato, margine antico anguste truncato.

Long. 12·5 mm.

♂. Mandibles long, strongly bent before the apex and bidentate; clypeus with a carina, head coarsely punctured, somewhat broader than long, subrectangular, rounded at the posterior angles, cheeks beneath with a stout and long spine, which is touched by the point of the long mandibles when they are closed. Pronotum strongly narrowed anteriorly, nearly as long as the mesonotum, the anterior margin short and transverse. Thorax strongly but rather sparsely punctured, very sparsely on the dorsulum, the mesopleuræ rugose. Median segment with a distinct triangular basal area occupying most of the dorsal surface, the base longitudinally striated, the apical portion obliquely striated at the sides, with a low longitudinal carina in the middle, on each side of which are short transverse striæ on an elongate-ovate surface; the segment is broader than long, rounded at the posterior angles, and vertically truncate posteriorly. Abdomen shining and almost smooth, with white hairs on the sides. Neuration as in *fuscipennis*. Tarsal ungues tridentate, the basal tooth obtuse. Recurrent nervure interstitial with transverse cubital nervure.

Hab. Simba, British East Africa, 3350 ft.; April (*S. A. Neave*).

A genus easily distinguished by the spine on the cheeks and the very long mandibles.

Pristocerus rosmarus, Stadelm., is very near this species, but the description of the pronotum does not correspond, the two deep transverse furrows and the longitudinal sulcus mentioned by him being absent in the present species. The spines on the cheek are very similar in the two species. *P. rosmarus* has been transferred by Stadelmann to his genus *Dicrogenium*, which is placed by Ashmead in his family Cosilidæ. I have not seen specimens of the genus, which is said to be without the lobe of the hind wing characteristic of the Bethylidæ. But I am inclined to look on the genus as an aberrant Bethylid, rather than transfer it to the position assigned to it by Ashmead.

Nomineia armaticeps, sp. n.

♂. Niger, rugose punctatus; tegulis fuscis; alis hyalinis, leviter infumatis; genis spina acuta armatis.

Long. 8 mm.

♂. Mandibles tridentate, the inner tooth not well defined, very short and blunt; second joint of the flagellum no longer than the third, the apical joints not much narrowed. Head much broader than long, front rugose, vertex coarsely punctured; eyes separated from the posterior margin of the head by a distance scarcely equal to their own length; cheeks armed beneath with a strong spine. Thorax coarsely punctured, mesopleuræ rugose; pronotum much narrowed in front, the anterior margin straight. Median segment broader than long, longitudinally striated at the base, the triangular dorsal area well marked, the sides of the area finely obliquely striated, the sides of the segment and surface of the apical truncation rugulose. Abdomen smooth and shining, with sparse white pubescence on the sides and ventral surface, the apical segment punctured. Tarsal ungues bidentate. Submedian cell incompletely closed, the nervures at the apex indistinct; recurrent nervure and first transverse cubital nervure indistinctly indicated, not interstitial. An indistinct nervure from the apex of the radius reaching nearly to the margin of the wing.

Hab. Harar, Abyssinia (*G. Kristensen*).

This is very nearly related to *N. spinigera* in the structure of the head and pronotum, but the mandibles are shorter. In both the transverse depression at the posterior margin of the pronotum is absent. In the present species the neuration is less developed than in *N. spinigera*, the submedian cell being imperfectly closed, the recurrent and transverse cubital nervures only indicated, and not interstitial as in *N. spinigera.*

PSEUDOCALYOZA, gen. nov.

♂. Antennæ twelve-jointed, joints 2–6 of the flagellum strongly produced at the apex on the outer side, but without a long lamella; pronotum long, narrowed anteriorly, not margined, and without a groove on the posterior margin; mesonotum with two longitudinal furrows on each side, scutellum with a fovea on each side at the base; median segment margined at the apex, with five longitudinal carinæ; tarsal ungues bifid, with a blunt lobe at the base; neuration as in *Calyoza.*

Pseudocalyoza subramosa, sp. n.

♂. Niger; antennis articulis septem basalibus, mandibulisque apice brunneo-ferrugineis; abdomine segmentis quinto, sexto, septimoque, quartoque dimidio apicali rufo ferrugineis; alis subhyalinis.

Long. 9·5 mm.

♂. Mandibles broad and short, tridentate at the apex, the outer tooth not much longer than the others. Clypeus with a carina; head and thorax closely, but not very coarsely, punctured; head broader than long, the eyes separated from the posterior margin by a distance not equal to their own length. Antennæ longer than the thorax and median segment combined, twelve-jointed, the scape no longer than the second joint of the flagellum and strongly curved, first joint of the flagellum very short, the other joints not differing much in length, joints 2–6 strongly produced at the apex on the outer side. Pronotum much longer than the mesonotum, strongly narrowed anteriorly; median segment distinctly broader than long, with five longitudinal carinæ, the lateral carinæ converging a little towards the apex, the space between them finely transversely striated. Abdomen shining, very shallowly and indistinctly punctured, with seven dorsal segments; hypopygium terminating in two long spines, as in Mutillidæ.

Hab. Mlanje, Nyasaland; November (*S. A. Neave*).

The antennæ are somewhat similar to those of *Pristocera laticornis*, Kieff., but in that species the lower discoidal cell is closed. The dilatation of the antennal joints reaches the ninth joint. There is no transverse groove on the pronotum in *subramosa.*

Genus PARACALYOZA, Cam.

Paracalyoza, Cam. Deutsch. ent. Zeit. p. 377 (1909).
Calyozina, Enderl. Ent. Mitth. Berlin, i. p. 203 (1912).

Paracalyoza hirtipennis, Cam.

Paracalyoza hirtipennis, Cam. Deutsch. ent. Zeit. p. 377 (1909). ♂.
Calyozina flavipennis, Turn. Ann. & Mag. Nat. Hist. (8) xiv. p. 245 (1914). ♂.

I had overlooked Cameron's description of this species. I do not think that there are sufficient reasons for separating the genus from *Calyoza*. Enderlein seems also to have overlooked Cameron's paper.

XXXIV.—*On the Pacific Species of* Hippoglossoides. By PETER SCHMIDT, Curator of the Ichthyological Department of the Zoological Museum of the Imperial Academy of Sciences in Petrograd.

THE genus *Hippoglossoides*, Gottsche (*Drepanopsetta*, Gill), is represented in the Atlantic Ocean, as has been shown by Collett (1878) and by Smitt (1893), by only one species—*Hippoglossoides platessoides*, Fabricius. The identity of American and European representatives of this species, formerly distinguished as *Hippoglossoides platessoides* and *H. limandoides*, is now conceded apparently by all European and American writers.

Very different at first sight are the conditions in the Pacific, where no less than five reputed species of *Hippoglossoides* are recognized :—

(1) *Hippoglossoides elassodon*, Jordan & Gilbert (1880), described from Seattle, Tacoma, and Puget Sound, and afterwards recorded from the Bering Sea by American naturalists, and by me from the Okhotsk Sea (Schmidt, 1904).

(2) *Hippoglossoides robustus*, Gill & Townsend (1897), described from one specimen only from the Bering Sea (lat. 56° 14′ N., long. 164° 08′ W., 49 fath.). Not found afterwards.

(3) *Hippoglossoides hamiltoni*, Jordan & Gilbert (1899), described from a specimen from Avatcha Bay. I recorded two examples from the Okhotsk Sea near Cape Terpeniya (Schmidt, 1904).

(4) *Hippoglossoides dubius*, Schmidt (1904), described from two specimens (one of them young) from the

North Japanese and Okhotsk Seas, and afterwards considered by American and Japanese authors [Jordan & Starks (1906), Jordan, Tanaka, & Snyder (1913)] to be the representative of a new genus—*Cynopsetta*, Schmidt [this name *Cynopsetta* was first used by me in a preliminary list (Schmidt, 1902) without description]. J. O. Snyder (1912, p. 439) has identified two specimens found in Otaru as nearest to this species, but "with some doubt as to whether the species itself really differs from *Hippoglossoides elassodon*."

(5) *Hippoglossoides katakuræ*, Snyder (1911), described from Otaru (Hokkaido) from one specimen *.

The near relationship of these five species has been generally acknowledged. Thus, of *Hippoglossoides hamiltoni*, Jordan & Evermann (1898, p. 2617) write:—"Allied to *Hippoglossoides elassodon* . . . Its relations with *H. robustus* are much nearer, but the species are apparently distinct." On the same subject I have written (Schmidt, 1904, p. 227):—"If we take into consideration that the Atlantic *Hippoglossoides platessoides*, a species nearly allied to *Hippoglossoides hamiltoni* and *H. elassodon*, is highly variable, and has, according to Smitt, D. 76–93, A. 64–73, it is doubtful if the separation of *H. hamiltoni* from *H. elassodon* is well grounded, inasmuch as there are very few specimens for comparison. Having studied my two specimens, I believe that *H. hamiltoni* may be perhaps regarded as a synonym of *H. elassodon*."

Of *Hippoglossoides dubius* I have written (Schmidt, 1904, p. 228) in the same work:—"It is nearly allied to *Hippoglossoides elassodon*, J. & G., differing in the more developed *dentes canini*, in the absence of scales on the interorbital space and on the snout, in the cycloid scales on the anterior part of the body, in the narrower interorbital space, and deeper caudal peduncle."

Table I. gives a comparison of the principal characters of

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* *Hippoglossoides herzensteini*, Schmidt (1904), was described by me from the North Japanese Sea as a *Hippoglossoides*. But in the same work I suggested that it might be better to consider it as the representative of a new genus—*Protopsetta*. Now I am convinced that this supposition was well grounded, inasmuch as it coincides with the opinion of American and Japanese ichthyologists [Jordan & Starks (1906), Jordan, Tanaka, & Snyder (1913)].

TABLE I.

	Hippoglossoides platessoides, Fabr.		*H. elassodon*, Jord. & Gilb.	*H. robustus*, Gill & Town.	*H. hamiltoni*, Jord. & Gilb.	*H. dubius*, Schm.	*H. katakuræ*, Snyd.
	Smitt.	Schmidt.	Jordan & Gilbert; Jordan & Evermann.	Gill & Townsend.	Jordan & Gilbert.	Schmidt.	Snyder.
Number of specimens studied	Many.	Many.	Many.	1	1	2	1
Size in millimetres	220–350	328–469	?–458	318	170	126, 393	320
Number of rays in D.	79–93 [101*]	85–96	77–87	76	72	85	80 †
" " A.	64–73 [79*]	69–76	59–67	60	56	67	69
Lateral line (number of pores)	85–102	92–109	88–92	95	91	88	93
Depth of the body in °/₀ of the total length..	33·0	34·1–39·4	40·0	45·0	41·6	33·3	40·0
Length of the head in °/₀ of the total length.	26 0	23·8–25·6	28 6	27·7	31·1	25·0	26·3
Diam. of the upper eye in °/₀ of the length of the head	....	16·7–22·0	25·0	18·5	28·5	16·6	21·3
Length of the snout in °/₀ of the length of the head	....	18·5–24·7	....	....	20·0	18·8	18·1
Length of P. in °/₀ of the total length......	9·1–12·2	9·5–10·8	14·3	13·8	16·3 ‡	....	....
Number of gill-rakers of the I. gill-arch below arch	....	10–13	14–16 §	11	11–12	14	12

* *Cf.* Collett, Norveg. North Atl. Exped., Fishes, p. 145.

† *Cf.* Proc. U.S. Nat. Mus. vol. xlii. p. 439.

‡ After the plate lxxxiv. (Jordan & Gilbert, 1899).

§ After Jordan & Evermann; in the original description of Jordan & Gilbert, 15–17.

the species of *Hippoglossoides* as described by different writers, and shows that the differences are very uncertain.

We see in Table I. that the number of rays in the dorsal and anal fins of *Hippoglossoides robustus* (D. 76, A. 60), *H. dubius* (D. 85, A. 67), and *H. katakuræ* (D. 80, A. 69) lies between the limits of variation of the number of rays in *H. elassodon* (D. 77–87, A. 59–67), or is very near to these, and only in *H. hamiltoni* (D. 72, A. 56) this number differs slightly. The depth of the body seems to be very different in *Hippoglossoides dubius* (33·3 °/o of the total length), but it is possible that the American ichthyologists have measured the length of the body from the tip of the snout to the *base* of the caudal, as measurements to the tip of the caudal, taken on the figures (Jordan & Gilbert, 1899, pl. lxxxiv.; Jordan & Goss, 1889, pl. ii. fig. 5) have given for *Hippoglossoides hamiltoni* 32·8 °/o and for *H. elassodon* 35·8 °/o of the total length—*i. e.*, nearly the same as in *Hippoglossoides dubius*.

A more marked difference seems to lie in the diameter of the upper eye; but everybody who has measured flat-fishes knows that this is the most variable and uncertain measure.

If we compare now other morphological features, we shall see that they give no good characters for separation of the five Pacific species of *Hippoglossoides*.

The *teeth* in the jaws in all the species are in a single series. In *Hippoglossoides elassodon* they are, according to Jordan & Gilbert (1880, p. 278), "in the upper jaw . . . small conical, not very sharp . . . somewhat larger in front than on the sides and also more widely set," "lower jaw with a single series of rather close-set teeth similar to those in the upper jaw or slightly larger; those on the sides smaller than the anterior teeth; number of the teeth about $\frac{35+45}{25+35}$." In *Hippoglossoides robustus*, Gill & Towns., after Jordan & Evermann[*] (1898, p. 2616), "teeth of the single row mostly separated from each other by intervals equal to width of teeth, curved inward and uniform on the sides; toward front 4 or 5 enlarged preceded by two smaller, leaving the middle toothless; in the lower jaw of nearly uniform size and inclining backward." In *Hippoglossoides hamiltoni*, after Jordan & Gilbert (1899, p. 489), "teeth acute, in a single series in each jaw, all except the anterior teeth in each jaw short. At the symphysis of lower jaw the teeth are longer and directed inward, while in the anterior end of each premaxillary the

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[*] I have not seen the original description of Gill & Townsend, as this volume of Proc. Wash. Biol. Soc. is wanting in our library.

TABLE II.

	Hippoglossoides elassodon elassodon.								*H. elassodon robustus.*				*H. e. dubius.*
	Okhotsk Sea.	Okhotsk Sea.	Tartar Strait.	Tartar Strait.	Okhotsk Sea.	Tartar Strait	Tartar Strait.	Tartar Strait.	Okhotsk Sea.	Okhotsk Sea.	Okhotsk Sea.	Avatcha Bay.	Tartar Strait.
Total length	368·5	273·7	249·0	223·0	206·5	202·0	196·7	178·0	220·0	205·0	158·2	146·0	431·0
Length of the body without C.	308·5	230·0	206·2	183·7	175·0	169·8	160·8	145·0	183·5	173·0	129·5	117·8	364·0
Number of rays in D.	81	79	86	81	83	82	86	84	71	72	75	73	87
„ „ A.	63	62	67	61	67	63	69	68	54	55	59	57	62
„ „ P.	12/11	10	11	11	12/11	11	10	11	9	11	11	11	10
Number of pores in lateral line	90	90	96	93	94	88?	90	91	93	87	88	90	96
Depth of the body in °/o of total length	33·6	30·6	30·5	30·7	30·2	31·6	28·3	31·3	32·6	31·2	30·8	30·2	32·8
Length of the head in °/o of total length	24·0	25·2	23·3	22·4	20·8	22·5	23·7	22·5	24·3	23·1	25·4	26·6	25·4
Diameter of the upper eye in °/o of length of the head	19·4	19·5	22·8	19·0	20·0	21·9	20·3	21·7	19·0	21·0	22·6	21·6	16·9
Interorbital space in °/o of length of the head	3·9	2·9	2·4	2·6	2·5	1·9	2·7	2·7	2·8	3·5	3·4	2·5	4·2
Length of the snout in °/o of length of the head.	22·6	25·7	22·1	23·6	26·0	23·3	24·4	22·5	24·3	27·1	21·6	20·9	25·9
Length of C. in °/o of total length	16·6	16·0	17·5	17·6	17·4	16·1	17·7	18·0	16·8	16·3	18·6	19·7	16·6
Length of P. „ „ „	9·2	10·9	10·1	11·0	10·7	11·5	12·2	10·1	11·3	10·6	10·4	10·6	8·6
Height of D. „ „ „	9·5	10·6	9·5	9·1	8·3	8·9	9·1	9·3	10·6	9·7	11·0	11·4	9·2

teeth are still more enlarged and the series on each side describes a strong curve with its convex side toward the median line." In *Hippoglossoides dubius*, after my description (Schmidt, 1904, p. 227), "the teeth are sharp, conical, somewhat directed inward, in a single row; on the anterior part of premaxillary 6 teeth of middle size and behind them on each side a group of 2–3 large canines; on the posterior part are smaller teeth; in the lower jaw are 4 canines on the symphysis." In *Hippoglossoides katakuræ*, after Snyder (1911, p. 546), "teeth are small, slender, in a single row on the symphysis, where they are irregularly placed, enlarged, and somewhat canine-like."

Comparing all these descriptions, we see that the teeth of the five species of *Hippoglossoides* are of the same general structure. They have all on the anterior part of the upper jaws and on the symphysis of the lower jaw some enlarged, curved, canine-like teeth, directed backward and set not so close as other small conical teeth.

The scales and their distribution are nearly identical in the five species; nor do other morphological features give differences sufficient for specific separation.

This preliminary comparison of diagnoses has convinced me that the five Pacific forms of *Hippoglossoides* cannot be regarded as well-defined species. Two of them—*Hippoglossoides hamiltoni* and *H. katakuræ*—I believe to be synonyms of *Hippoglossoides robustus* and *H. elassodon*. It is really impossible to find in what *Hippoglossoides hamiltoni* differs from *H. robustus*. The differences of four rays in the dorsal and anal and of four pores in the lateral line is too insignificant, considering the high degree of variation of the fin-rays and pores in *Hippoglossoides* (*cf.* Table II., p. 303). Jordan & Evermann give as distinctive the length of the pectoral—½ the length of head (=13·8 °/₀ of total length) in *Hippoglossoides robustus* and ⅔ length of head (=16·3 °/₀ of total length) in *H. hamiltoni*. But if we take into consideration that the specimen of *H. robustus* was 318 mm. long and the specimen of *H. hamiltoni* only 170 mm., and that, in general, younger forms have comparatively longer pectorals and caudals, we shall understand that this difference cannot be regarded as sufficient for separation. The wider interorbital space, the smaller symphysial knob, the larger nasal tubes of *Hippoglossoides hamiltoni* are also features connected with youth, and the roughness of the scales and the form of the anterior part of the lateral line is highly variable in *Hippoglossoides*.

In the same manner it is impossible to distinguish *Hippoglossoides katakuræ* from *H. elassodon*. The depth of the body seems to be not higher, as Snyder gives, but the same as in *H. elassodon* ($40\,^{0}/_{0}$ of the length to the base of caudal); the number of rays in the dorsal is also not greater (*cf.* Snyder, 1912, p. 439) than in this species. Only the lateral line seems to form a more abrupt and higher arch; but this feature is highly variable, and one can find in *Hippoglossoides elassodon* all the transitional stages.

Studying now the Heterosomata of the Russian seas in the Zoological Museum of the Imperial Academy of Sciences in Petrograd, I have examined the large material on Pacific forms of *Hippoglossoides* collected by different Russian expeditions during the last ten years, and I have re-examined also my former material. This study brings me to the conviction that in the Pacific Ocean there is, as in the Atlantic, only one well-defined species of *Hippoglossoides*, with three highly variable subspecies.

The material examined consisted of forty-six specimens of different sizes; one part of these was accurately measured on a detailed scheme, and percentage values were calculated.

By these detailed studies I could not find the limits of three species which seemed to me to be well defined in my first examination twelve years ago. All these species—*Hippoglossoides elassodon*, *H. robustus*, and *H. dubius*—were represented in our collections, but they were so connected through different transitions that it was not possible to separate them from one another. They must therefore be regarded not as separate species, but as subspecies (or varieties) of one species—*Hippoglossoides elassodon*, Jord. & Gilb.

The most characteristic of these three forms is *Hippoglossoides elassodon dubius*, which is distinguished by the strong, curved, canine-like teeth on the anterior part of the premaxillaries and on the symphysis of the lower jaw; but the number and position of these teeth are the same as in other forms—only they are more developed, sometimes twice as long as the other teeth. All the other features formerly considered by me as distinguishing characters lie within the limits of variation of both the other forms.

The number of rays in the fins of *Hippoglossoides elassodon dubius* is also not characteristic; we find in our collection the following variation:—

D.	77	81	83	84	85	87	90	rays.
	2	1	2	1	2	2	1	specimens.

A.	57	62	63	65	66	67	rays.
	1	2	1	1	2	4	specimens.

All the specimens of our collection attributed by me to *H. elassodon dubius* are 300–431 mm. long, and in the smaller specimens I have never found such development of canine-like teeth. Therefore it may be supposed that *H. elassodon dubius* is nothing more than older specimens of *H. elassodon*. But, on the other hand, we see that this form is restricted to a separate geographical area: all the specimens of our collection are from Tartar Strait (North Japanese Sea). It may be, therefore, that it is a distinct subspecies, and as such I consider it for the present.

The forms *Hippoglossoides elassodon elassodon* and *H. elassodon robustus* can be distinguished by the number of rays in dorsal and anal. I attribute to the forma typica specimens having D. 77–86, A. 60–69, and to *Hippoglossoides elassodon robustus* specimens with D. 67–75, A. 51–59. In our collection we find the following distribution:—

Hippoglossoides elassodon elassodon.

D.	76	79	81	82	83	84	85	86	rays.
	1	1	4	4	2	1	2	2	specimens.

A.	60	61	62	63	64	66	67	68	69	rays.
	1	2	1	4	3	2	2	1	1	specimens.

Hippoglossoides elassodon robustus.

D.	67	68	69	71	72	73	74	75	76	77	rays.
	1	2	1	3	1	1	1	2	1	1	specimens.

A.	51	52	53	54	55	56	57	59	rays.
	1	1	1	3	2	1	2	2	specimens.

The specimens of *H. elassodon robustus* having D. 76 and D. 77 could be attributed to *H. elassodon elassodon*, but they have at the same time a very low number of anal rays (A. 57, A. 59), and must be regarded therefore as transitional forms. This Table demonstrates sufficiently clearly that we have here only one variation row with two maximums, *i. e.* two nearly connected forms of one species.

In other respects both forms are also nearly connected, as is shown in Table II.* (p. 303), representing the chief features.

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* This Table is only an extract of the results of my measurements. More complete tables, detailed diagnoses, and synonymy of the Atlantic and Pacific species of *Hippoglossoides* will be published in my monograph of Russian Heterosomata, forming a volume of 'Faune de la Russie,' published by the Imperial Academy of Sciences of Petrograd.

If we try now to summarize the facts given above, we shall have the following scheme:—

Genus HIPPOGLOSSOIDES, Gottsche, 1835.

[=*Citharus*, Reinhard, 1838,=*Drepanopsetta*, Gill, 1861,=*Pomatopsetta*, Gill, 1864,=*Cynopsetta* (Schmidt *in litt.*), Jordan & Starks, 1906.]

I. Branchiostegal rays 8. Lateral line single, nearly straight. The contours of the dorsal and anal fins in the posterior half convex. (Atlantic Ocean.) .... *H. platessoides*, Fabr.

II. Branchiostegal rays 7. Lateral line single, slightly rising anteriorly or forming a very low arch. The contours of the dorsal and anal fins in the posterior half concave. (Pacific Ocean.) .... *H. elassodon*, Jord. & Gilb.

  a. The prominent teeth in the anterior part of the upper and lower jaws large, canine-like .... *H. elassodon dubius* (Schmidt).

  b. The prominent teeth in the anterior part of the upper and lower jaws not very large.

    α. The number of rays in dorsal fin 76-86, mostly 81-83; in anal 60-69, mostly 63-67 .. .. *H. elassodon elassodon* (Jord. & Gilb.).

    β. The number of rays in dorsal fin 67-75, mostly 71-74, in anal 51-59, mostly 54-56 .... *H. elassodon robustus* (Gill & Towns.).

The synonymy of the three subspecies of *Hippoglossoides elassodon*, Jordan & Gilbert, will be as follows:—

1. *Hippoglossoides elassodon dubius* (Schmidt).

Cynopsetta dubia, Schmidt (*in litt.*), 1902.
Hippoglossoides dubius, Schmidt, 1904.
Cynopsetta dubia, Schm.; Jordan & Starks, 1906.
Hippoglossoides dubius, Schm.; Snyder, 1912.
Cynopsetta dubia, Schm.; Jordan, Tanaka, & Snyder, 1913

2. *Hippoglossoides elassodon elassodon* (Jord. & Gilb.).

Hippoglossoides elassodon, Jordan & Gilbert, 1880.
„ „ Bean, 1881.
„ „ Jordan & Gilbert, 1883.
„ „ Jordan & Goss, 1886.
„ „ Jordan & Evermann, 1898.
„ „ Jordan & Gilbert, 1899.
„ „ Schmidt, 1902, 1904.
„ „ Jordan & Starks, 1906.
„ „ Gilbert & Burke, 1910.
Hippoglossoides katakuræ, Snyder, 1911, 1912.
Hippoglossoides elassodon, Jordan, Tanaka, & Snyder, 1913
Hippoglossoides katakuræ, Sn.; Jordan, Tanaka, & Snyder, 1913.

3. *Hippoglossoides elassodon robustus* (Gill & Town.).

Hippoglossoides robustus, Gill & Townsend, 1897.
„ „ Jordan & Evermann, 1898.
„ „ Jordan & Gilbert, 1899.
Hippoglossoides hamiltoni, Jordan & Evermann, 1898.
„ „ Jordan & Gilbert, 1899.
„ „ Schmidt, 1902, 1904.
„ „ Jordan & Starks, 1906.
„ „ Jordan, Tanaka, & Snyder, 1913.

It is possible, as I have mentioned above, that more detailed investigations of a larger material may prove that *Hippoglossoides elassodon dubius* is merely an age-variation of the forma typica. In this case we shall have in the Pacific only one species of *Hippoglossoides*, with two subspecies differing in geographical distribution, as *Hippoglossoides elassodon robustus*, according to our collections, belongs more to the northern parts of the Okhotsk Sea, while *Hippoglossoides elassodon elassodon* (and *H. e. dubius*) is more represented in the southern parts of Okhotsk Sea and in the North Japanese Sea (Tartar Strait).

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XXXV.—*A Special Genus for the Himalayan Bat known as* Murina grisea. By OLDFIELD THOMAS.

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THE teeth of *Murina grisea* differ so markedly from those of the other species of *Murina* that I think it should be separated from them to form a special genus, which might be called

HARPIOLA, gen. nov.

External characters as in *Murina*, except that the wing-membrane is attached to the base of the first toe, instead of near its claw, as is ordinarily the case in *Murina.*

Teeth remarkable for the almost complete suppression of the usual specialization of the canine, the upper incisors, canine, and premolars being all subequal in size and closely similar in shape; the incisors therefore comparatively enormous, nearly as large as the reduced canine, the second one pressed close against the front of the latter. Canine scarcely higher than the anterior premolar, which, in turn, is actually larger in all dimensions (except in its outer antero-posterior diameter) than the second, the converse being the case in all species of *Murina.* Below, the incisors are, as usual, quite small, but the canine is again reduced, less in height than the first premolar—this, in turn, very slightly less than the posterior premolar. Upper molars with the metacone so reduced as to be scarcely higher than the paracone, which it ordinarily far surpasses.

In transverse area all the anterior teeth, incisors, canines, and premolars are remarkably broad and bulky, while the molars are unusually narrowed; as a result, both the canine and first premolar are each as broad as the molars, a proportion unknown elsewhere in the family except in the genus *Harpiocephalus.*

Genotype. *Harpiola grisea* (*Murina grisea,* Peters).

It is noticeable that the molars, usually so uniform in their structure, should in this one subfamily, the Murininæ, be so variable—the three genera, *Murina, Harpiola,* and *Harpiocephalus,* being readily distinguishable from each other by their molar structure only.

The typical species of *Harpiola, H. grisea,* is unfortunately as yet only known by the type-specimen in the British Museum, and this, like others of the series collected by

Capt. Hutton, has undergone certain vicissitudes which have affected the condition of the skull. No cranial characters can therefore be described, and even the teeth appear to be a little distorted and shrunk; but this can in no way affect the distinguishing marks on which the genus is based.

XXXVI.—*A new Genus of Phyllostome Bats and a new* Rhipidomys *from Ecuador.* By OLDFIELD THOMAS.

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AMONG a small collection of mammals from Baeza, Oriente of Ecuador, presented to the National Museum by Mr. Walter Goodfellow, there occurs, besides such rarities as *Artibeus glaucus, Diphylla ecaudata, Nasua judex,* and *Oryzomys balneator,* an example representing a new genus and species allied to the common *Sturnira lilium* of the same region.

It may be described as follows:—

CORVIRA, gen. nov.

General characters as in *Sturnira,* but only two lower incisors present.

External structure apparently quite as in *Sturnira,* though the nose-leaf and ear may show some differences when spirit-specimens are examined. Interfemoral membrane similarly reduced. No glandular shoulder-tufts perceptible.

Skull of the general shape of that of *Sturnira,* but the muzzle and interorbital region rather narrower. Angular process of mandible shorter.

Teeth of the same non-cuspidate character as those of *Sturnira.* Upper incisors more disproportionate than in that genus, the outer ones smaller and narrower, the inner pair longer and slenderer, with a small supplementary basal cusp postero-externally; breadth of the whole incisor-row much less than in *Sturnira,* not equalling the length of the canine. Premolars and molars all slightly separated from each other; the premolars evenly oval transversely, their breadth about three-fourths that in *Sturnira,* while their antero-posterior diameter is only about half. M^1 subtriangular, with rounded angles, more carnassial-shaped than in *Sturnira*; other molars about as in *Sturnira.* Throughout the series all cusps are obsolescent and rounded as in *Sturnira*, though perhaps a little less so.

Lower incisors only two, bicuspid, in the narrow space in front of the nearly approximated canines. Other lower teeth separated from each other, of about the same breadth, but shorter antero-posteriorly than their homologues in *Sturnira*.

Type. *Corvira bidens*, sp. n.

Owing to the extreme isolation of *Sturnira*, considered by Miller as forming a special subfamily, the discovery of another genus allied to it is of much interest. In the more triangular shape of m^1 and rather better developed cusps to some of the teeth, *Corvira* is perhaps slightly less specialized than *Sturnira*, while in the total suppression of the outer lower incisors it has a peculiarity unknown in this group of the Phyllostomidæ.

Corvira bidens, sp. n.

Size and general appearance very much as in *Sturnira lilium*. Fur close, velvety, hairs of back about 6 mm. in length. General colour above dark grey-brown—nearly "blackish brown,"—the individual hairs pale brown for their basal half, silvery grey for their next fourth, their tips blackish; the crown blacker, across the shoulders rather greyer, the back again blacker, but these differences quite slight. Under surface uniformly brown (near mummy-brown), the hairs brown to their bases. Legs and feet hairy, as in *Sturnira*, the feet proportionally rather larger. Wings uniformly brown.

Skull and teeth as described above.

Dimensions of the type (which is somewhat immature):—

Forearm 43 mm.

Head and body (on skin) 73; nose-leaf (dry) 7; ear (dry) from internal base 10; third finger, metacarpus 42, first phalanx 17, second phalanx 21·5; foot (c. u.) 16.

Skull: greatest length 22·2; condylo-basal length 20; zygomatic breadth 12·5; interorbital breadth 5·5; mastoid breadth 11·7; palatal length 10; front of canine to back of m^3 6·7; breadth between outer corners of m^3 7.

Hab. (of type). Baeza, Upper Coca River, Oriente of N. Ecuador. Alt. 6500′.

Type. Immature male. B.M. no. 15. 7. 11. 7. Original number 19. Collected April 1914, and presented by Walter Goodfellow, Esq.

The peculiar knack possessed by Mr. Goodfellow of capturing remarkable novelties, even when unable to make considerable collections, is again exemplified by his discovery of this interesting bat, which, so like the common *Sturnira lilium* externally, represents a most distinct new genus.

So great is this external resemblance of *Corvira bidens* to *Sturnira lilium*, that the only distinguishing character I can at present point out is the decidedly darker colour, especially below, all the other features being occasionally found in the latter animal. Should any mistake have occurred in the allocation of the skin to the skull, the latter should, of course, be taken as the type of the new form.

Rhipidomys equatoris, sp. n.

Closely related to *R. leucodactylus*, but with grey-mixed belly.

Size large, just about as in *leucodactylus*. Fur short and crisp. General colour above lined greyish with a slight tinge of fulvous, but the members of this genus vary so much in their range of colour from fulvous to grey that little stress can be laid on the exact shade of the fur. Under surface uniformly bluish grey, the bases of the hairs slaty, the tips dull whitish; chin and throat-hairs white to the base. Hands and feet particoloured as in *leucodactylus*, the metapodials mesially dark brown, the edges and digits white. Tail well-haired, wholly dark brown.

Skull quite like that of *R. leucodactylus*, and differing equally from that of *R. lucullus* by its smaller size and markedly smaller brain-case.

Dimensions of the type (measured in the flesh):—

Head and body 175 mm.; tail 220; hind foot 32; ear 21.

Skull: greatest length 40; condylo-incisive length 37·5; zygomatic breadth 21; nasals 14·4; interorbital breadth 6·1; breadth of brain-case 15·8; palatilar length 17·1; palatal foramina 8·4; upper molar series 7.

Hab. San Domingo, W. Ecuador (79° 6′ W., 0° 13′ S.). Alt. 1600′.

Type. Adult female. B.M. no. 15. 1. 1. 39. Original number 414. Collected 8th July, 1914, by Gilbert Hammond. Presented by Oldfield Thomas. Two specimens.

This Ecuadorean *Rhipidomys* differs from the common *R. leucodactylus* of Peru by its grey belly, that species having the median ventral area quite white. From *R. lucullus*, which similarly has a greyish belly, it differs by its smaller skull, and especially its smaller brain-case.

XXXVII.—*Further Notes on Asiatic Bamboo-Rats.* By Oldfield Thomas.

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Since writing my "Notes on the Asiatic Bamboo-Rats"[*] I have had, thanks to the kindness of Dr. Annandale, the opportunity of examining typical specimens of the species described by Blyth as *Rhizomys pruinosus* and *castaneus*, and am therefore now able to make a further contribution to the subject.

Rhizomys pruinosus, Blyth[†].

This species was described from Cherra Punji, Khasia Hills, Assam, and specimens have since been referred to it from various localities to the eastward as far as Yunnan. Now, however, on comparison with the typical specimen obtained by Mr. Skipwith at Cherra Punji, I find that the more eastern specimens are distinguishable by their greater size. The British Museum only contains young specimens from the Khasia and Naga Hills; but Mr. Skipwith's specimen, fully adult, has a palatilar length of only 32·2 mm., with length of upper molar series (crowns) 12 mm.; breadth of m^1 4·7. Compared with this the eastern form may be described as follows:—

Rhizomys senex, sp. n.

As in *R. pruinosus*, but size larger and teeth heavier.

Colour and general appearance quite as in *R. pruinosus*, the fur similarly long, soft, slaty blackish, profusely grizzled with the white tips to the longer hairs. Under surface paler slaty varying towards greyish white. Hands and feet brown. Mammæ 1—3=8.

Skull, as gauged by teeth, decidedly larger than in *R. pruinosus*, but no perfect skull, fully adult, of the latter is available. The zygomata are also decidedly broader (vertically), the median height being in *senex* 9 mm., as compared with 7·5 in *pruinosus* and 6·5 in *sinensis*. On the whole, the skull is most like that of *R. sinensis*, but has a broader and lower occipital plane, and, as indicated by its measurements above, broader zygomata.

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[*] Ann. & Mag. Nat. Hist. (8) xvi. p. 56 (1915).

[†] J. A. S. B. xx. p. 519 (1851).

Skull-dimensions of the type :—

Condylo-basal length 67 mm. ; condylo-incisive length 66 ; zygomatic breadth 48·7 ; nasals 25 × 8·7 ; anteorbital foramen 6·2 × 5 ; greatest breadth on frontals 18·7 ; interorbital breadth 10·5 ; height of crown from alveolus of m^3 27·8 ; occipital plane, height from basion 22·5, breadth 33 ; palatilar length 37·2 ; palatal foramina 6·7 ; upper molar series (crowns) 15 2 ; breadth of m^2 5·6.

Hab. Eastern Burma and Yunnan. Type from Yunnan, probably from the neighbourhood of Mong-tze.

Type. Adult female. B.M. no. 12. 7. 25. 42. Original number 4. Collected 9th June, 1910, by H. Orii.

Distinguished from *R. pruinosus* by its greater size, this species is separable from *R. sinensis* by the definitely hoary character of its fur, that animal being practically without the white-tipped longer hairs which give so marked a character to *R. pruinosus*, *latouchei*, and *senex*. In this respect, therefore, *R. sinensis* approaches the unicolor soft-furred Chinese species *R. vestitus* and *davidi*.

CANNOMYS.

The uncertainty about the identity of Blyth's *Rhizomys castaneus*, said to be from "Arakan," has hitherto prevented consideration of the different species and races of *Cannomys*. Now, however, the examination of the specimen sent by Dr. Annandale as typical of *castaneus* * enables me to make a preliminary attempt at the arrangement of the group—but it is very far from complete or satisfactory.

The specimen of *C. castaneus* is skull no. 403 of the Indian Museum, and I find it closely agrees with examples in the British Museum from Thaton, Tenasserim, and is clearly the same form. Whether the species is really to be found in Arakan remains to be seen when that little-known country is properly explored.

Thanks to the splendid work of the Bombay Natural History Society, series of these red bamboo-rats have been obtained on the Chindwin, in the Shan States, and on Mt. Popa, thus effectively supplementing those which the Museum possessed from Sikkim, Manipur, Siam, Tenasserim, &c.

Externally there is little difference between the different local forms. All are of similar proportions and all, with one exception, have the coat washed terminally with some shade of rufous, which may be brighter in some and deeper in others, but the difference is never beyond the range of individual variation. On the analogy of other burrowing rodents, one might have expected to find a considerable number of plumbeous individuals in all districts, but, curiously enough, these only occur in a single race—that of the Shan States plateau,—and there they are in a majority, a small minority of the individuals only being of the normal rufous coloration.

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* *Rhizomys castaneus*, Blyth, J. A. S. B. xii. p. 1007 (1843).

Even in the skull the differences are few in number and not very striking. General size and size of teeth are the most important, the other cranial proportions being much the same in all.

The following are the names and characters of the different races I recognize. For the use of the words connoting size, justification must be sought in the table of cranial measurements (p. 316). All the characters are based on series, and in every locality occasional individuals may be found not quite true to type.

1. *Cannomys badius*, Hodgs.

Large, with large teeth. Zygomata of medium expansion. Colour normal.

Nepal (*Hodgson*), Sikkim (*Hodgson, Charlton, Blanford*), Khasia Hills (*Blanford*), Manipur (*Hume*), Chindwin (*Bombay Survey*), Kakhyen Hills (*Anderson*).

2. *Cannomys pater*, sp. n.

Size largest of genus, but the teeth generally smaller than in *badius*. Zygomata widely spread and well developed vertically. Colour paler and brighter than in *badius*, near "pinkish cinnamon," but, owing to the gloss, far brighter than the dull tone of the colour-book.

Mt. Popa, dry zone of Burma (*Bombay Survey, Shortridge Coll.*).

Type. Adult female. B.M. no. 14. 7. 19. 231. Original number 3574. Collected 5th September, 1913, by G. C. Shortridge. Presented by the Bombay Natural History Society.

3. *Cannomys castaneus*, Blyth.

Size small ; the teeth also very small.

3 *a*. *Cannomys castaneus plumbescens*, subsp. n.

Colour commonly uniform plumbeous, only two specimens out of a dozen having any rufous, and even these being darker than the normal.

Skull-measurements.

	Sex.	Condylo-basal length.	Zygomatic breadth.	Upper molar series (crowns).	Breadth of m^1 on front face.
Cannomys badius.		mm.	mm.	mm.	mm.
Type. Nepal. B.M. no. 43. 1. 12. 61	♂	50	37	10·3	4·0
Darjiling. B.M no. 58. 6. 24. 96	—	47	36	10·9	4·1
Chindwin. B.M. no. 15. 5. 5. 240	♂	49	36·5	10·6	4·0
C. pater.					
Mt. Popa. B.M. no. 15. 9. 5. 1	"♀"	53·5	40 4	11·3	3·9
" B.M. no. 14. 7. 19. 229	♂	53·5	40·3	10·2	3 8
Type. Mt. Popa. B.M. no. 14. 7. 19. 231 ..	♀	49 3	38·5	10·3	3·8
C. castaneus plumbescens.					
Type. Gokteik. B.M. no 14. 7. 8 48	♀	46·4	33·6	9·3	3·5
Gokteik. B M. no. 14. 7. 8. 49	♀	45	33·3	9 0	3·4
" B.M. no. 14. 7. 8. 50	♀	46 3	34	9·4	3·3
C. castaneus castaneus.					
Indian Mus., Calcutta. No. 403 (typical) ..	?	(c.) 43 5	32·6	8·2	3·4
Tenasserim. B.M. no. 89. 7. 30. 1	♀	44	34	9·3	3·5
C. minor.					
Chiengmai. B.M. no. 2. 6. 6. 11	♂	46·7	38·3	10·3	4·4
" B.M. no. 2. 6. 6. 12	♀	49·6	38·7	10·4	4·3
Nan. B.M. no. 97. 11. 2. 24	♀	46	33·8	10	3·8
Raheng. B.M. no. 14. 6. 18. 27	♂	48·7	35·2	10·6	3·9

Plateau of Northern Shan States. Type from Gokteik, 2130′, other specimens from Pyaunggaung, 2790′, and Mansam Falls, 2000′.

Type. Adult female. B.M. no. 14. 7. 8. 48. Original number 2756. Collected 22nd April, 1913, by G. C. Shortridge. Presented by the Bombay Natural History Society.

A dark plateau representative of *C. castaneus*. The zygomata are generally stronger than in true *castaneus*, but not invariably so, and as the plumbeous coloration is also not invariable, I have only distinguished this form as a subspecies, in spite of the considerable difference in locality.

3 *b*. *Cannomys castaneus castaneus.*

Colour about as in *badius*, or rather brighter. Zygomata slender.

Tenasserim, Thaton (*Davison*, *Blanford*). Type-locality said to be Arakan.

4. *Cannomys minor*, Gray.

Size variable. Teeth large. Colour chestnut or brownish.

Hab. Siam.

I am not at present able to come to any satisfactory conclusion about the Siamese bamboo-rats. Northern specimens, from Chiengmai and Nan, can hardly be distinguished from examples of *C. badius*, but they vary considerably among themselves. The Museum collection contains specimens, in addition, from Raheng (*Barton*) and Pechaburi (*Mouhot*), besides the immature and much deteriorated type (B.M. no. 79. 11. 21. 526), which was obtained during the Finlayson mission of 1821–2.

XXXVIII.—*Upon a Remarkable new Genus of Lamellicorn Beetles from Borneo.* By GILBERT J. ARROW.

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THE rare and interesting insects forming the small group Aclopinæ have been known up to the present time only in two widely separated parts of the world—the southern part of South America and the northern part of Australia. Remote as these regions are from one another, it is now fairly well recognized that the strong points of resemblance in their faunas indicate that they have not always been separated as completely as they now are. The representatives of the group in Australia and South America respectively are very closely related, and the new form here described is the most isolated yet known. While differing little from *Phænognatha* and *Aclopus* in the essential features of the group (the peculiar development of the mandibles and labrum, the reduction of the maxillæ and labium and of the number of joints in the antenna), in other characters common to all the hitherto-known species (the greatly reduced abdomen, long metasternum, and consequent far-back position of the hind legs, and the extreme slenderness of the tarsi) it differs entirely. It is also peculiar in the great size of the club of the antenna, a feature, of course, distinctive of the males, and also in a still more interesting particular, in all probability peculiar also to that sex, viz., the cleft inner claw of the front foot. The absence of the female is another significant point of agreement with *Phænognatha* and *Aclopus*, of which only a single female specimen has yet been recorded, although the species appear to be fairly numerous. Probably in all the genera the females are sluggish and of quite different habits to the males.

XENACLOPUS, gen. nov.

Corpus latum, ubique erecte ciliatum. Caput breve, oculis desuper visis parvis, lateraliter haud prominentibus. Clypeus brevissimus, antice late arcuatus. Labrum valde porrectum, corneum, fere semicirculare. Mandibulæ detectæ, fere semicirculares, haud acuminatæ aut dentatæ, supra concavæ. Maxillæ multo reductæ, muticæ, palpis longis, 4-articulatis. Mentum solidum, acuminatum, palpis terminalibus, longis. Omnium palporum articulus ultimus longissimus. Antennæ 9-articulatæ, clava triphylla. Pedes validi. Coxæ grandes contiguæ, anticæ latissimæ, intus prominentes. Femora 4 posteriora lata. Tibia antica fortiter 3-dentata, posteriores extus transversim carinatæ et spinosæ. Tarsi longitudine ad tibias fere æquales. Abdomen subtus 6-articulatum, paulo contractum.

♂, antennarum articuli 3 ultimi grandes, longitudine ad stipitem æquales, basi angusti, deinde valde dilatati; pedum anticorum unguis internus profunde fissus.

Xenaclopus borneensis, sp. n.

Parvus, breviter oblongus, castaneus, nitidus, capite, scutello, elytrorum sutura et marginibus externis abdomineque nigris; corpore toto cum pedibus longe sed sparsim erecte ciliato; capite laxe rugoso, pronoto et elytris grosse æqualiter haud crebre punctatis, punctis piliferis; pronoto leviter convexo, lateribus fortiter et regulariter arcuatis, angulis anticis paulo acutis, posticis obsoletis; scutello sat magno, brevi, haud acute angulato; elytris valde convexis, humeris prominentibus; abdomine toto tecto.

Long. 4·5 mm.; lat. 2·5 mm.

Hab. SARAWAK: Mt. Merinjak (600–1500 ft., May); Lundu (January).

Male specimens of this very interesting insect were found by Mr. G. C. Bryant upon foliage in the jungle on various occasions in 1914, but no females were seen.

It is a small creature of rather short compact form, with a shining surface, varying in colour from light chestnut to nearly black, and sparsely studded everywhere with long bristling hairs arising from large pits. The legs are stout and the antennæ end in a massive club (distinctive, of course, of the male), which constitutes the most striking feature of the insect. Each antenna consists of nine joints, the first not long, the second globular, the third long and slender, the fourth and fifth each about half the length of the third, the sixth very short, and the last three very large, longer than the entire foot-stalk and shaped like the section of a pear, narrow at the base and at the widest part nearly half as wide as long. The front tibia bears three very strong and sharp external teeth, the middle and hind tibiæ are very spinose externally and at their extremities, where they are rather dilated, and bear long terminal spurs. The claws are strongly curved, but not very long, simple and symmetrical, except the inner front one, which is deeply cleft.

XXXIX.—*Upon the Beetles of the Melolonthid Genus* Rhopæa *found in the Fiji Islands.* By GILBERT J. ARROW.

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IN revising the genus *Rhopæa*, in the Trans. Roy. Soc. of S. Australia, vol. xxxv. (1911), Blackburn mentions that it appears to be, on the whole, a South Australian genus. In addition to the species known to him, however, one, of which he makes no mention (*R. vitiensis*, Fairm.), has been described from the Fiji Islands and I am now adding two others recently received from the same islands, where one of them at least is a serious pest, its grubs feeding upon the roots of sugar-cane.

The two new species are smaller than the one first described, of which the British Museum possesses a co-type.

The three species are very closely related, and all have been found in the same island, Viti Levu. Although forming a separate group, the features which divide them from the Australian forms of *Rhopæa* are so slight that there appears to me no sufficient reason for excluding them from the genus. They differ from the more typical species in having a narrower pronotum, angulated at the sides and not dilated, with a slight pit near the middle, in which is aggregated a cluster of the fine setæ with which the body is clothed. The basal joint of the hind tarsus is distinctly longer than the succeeding one, the tooth beneath the claws is very minute, placed near the base and united with the basal dilatation, and the antennal club consists of six lamellæ in the male and three in the female. The spurs of the hind tibiæ are slender in the male, broad and blunt in the female, with the terminal part thin and translucent. In the Australian species of *Rhopæa*, as Blackburn has pointed out, these spines are slender in both sexes.

The three Fijian species may be distinguished by the following differential characters:—

Sculpture of the upper surface very fine and dense ..	*vestita*, sp. n.
Sculpture of the upper surface not very fine and dense.	
Rather shining; elytra distinctly punctured	*subnitida*, sp. n.
Not shining; elytra rugose	*vitiensis*, Fairm.

Rhopæa vestita, sp. n.

Fusco-rufa, abdomine nigro, setis minutis decumbentibus griseis omnino vestita, pectore denso sat longo fulvo-hirto; corpore haud longe ovali, convexo, capite crebre punctato, fronte magis grosse et rugose; clypeo lato, margine antico reflexo, medio leviter sinuato; pronoto haud lato, dense ruguloso-punctato, lineola minuta mediana lævi fossulaque anteriori denso setosa, lateribus medio fortiter angulatis, angulis posticis quam anticos fere acutioribus; elytris subtiliter et denso rugulosis, vix costatis; pygidii medio lævi, lateribus rugulosis et setosis:

♂, antennarum articulo 4° spinoso, 5° modico producto, 6°–10° subæqualiter lamellatis.

Long. 15–18·5 mm., lat. max. 8–9·5 mm.

Hab. Viti Levu, Sigatoka Dist. (May to August, *R. Veitch & D. S. North*); Nadi Dist. (*J. F. Illingworth*).

Large numbers of this insect have been found in all stages in the sugar-plantations by Mr. R. Veitch, who intends shortly to publish an account of it from the economic standpoint.

It is smaller than the hitherto-known species of *Rhopæa*, reddish brown in colour, with a black abdomen, very finely and densely sculptured upon the pronotum, scutellum, and elytra, and clothed with closely-set minute yellowish setæ, except upon the breast, which is densely covered with moderately long yellow hair. The head is rather coarsely sculptured and scantily setose, and the pygidium is rather closely rugose and setose at the sides, with a quite bare, smooth, longitudinal area along the middle. The legs are slender and the tarsi not long, those of the hind legs very short in the female. The antennal club of the male is not very long (rather shorter than the foot-stalk), with the fourth joint minutely spinose, the fifth about half the length of the club, the sixth a little shorter than the latter and the last four of equal length.

Rhopæa subnitida, sp. n.

Fusco-rufa, subnitida, setis minutis decumbentibus griseis haud dense vestita, pectore dense fulvo-hirto; corpore sat longe ovali, convexo, capite grosse et rugose punctato, clypeo lato, margine antico haud fortiter reflexo, trisinuato; pronoto haud profunde aut minute rugoso-punctato, fossula minuta mediana densius setosa, lateribus post medium angulatis, angulis anticis et posticis obtusis; elytris fortiter sat crebre fere rugose punctatis, vix costulatis; pygidio rugose punctato, æqualiter haud crebre setoso:

♂, antennarum articulo 4° breviter lamellato, 5° elongato, 6°–10° æqualiter lamellatis.

Long. 16·5–19·5 mm., lat. max. 8–9·5 mm.

Hab. Viti Levu, Sigatoka Dist. (*D. S. North*).

Two specimens of each sex were sent, together with the other and apparently commoner species. It is closely similar to *R. vestita*, but rather more narrow and elongate, with the sculpture of the pronotum and elytra considerably less fine and dense, the clothing of grey setæ less close, and the surface exhibiting a silky lustre which is absent from the other species. The pygidium is rather coarsely punctured and scantily setose all over, without any trace of the smooth median area characterising *R. vestita*. The clypeus is less finely punctured and its front margin more strongly excised, the sides of the pronotum are less sharply angulated and the hind angles blunter. The antennal club of the male is a little longer, the fourth joint of the antennæ is produced into a short lamella, the fifth is only a little shorter than the club, and the last five are of equal length.

The remaining Fijian species, *R. vitiensis*, Fairm., is larger than either of the new species, with the setæ upon the upper surface more irregularly distributed and the elytra rather coarsely rugose, without definite punctures.

XL.—*Rhynchotal Notes.*—LVI. By W. L. Distant.

Homoptera.

Fam. Membracidæ.

Oxyrhachis egyptianus, sp. n.

Body and legs black, basal half of posterior pronotal process more or less sanguineous; tegmina obscure subhyaline, veins black, basal area black with an ochraceous spot; pronotum very finely greyishly pilose, percurrently centrally, longitudinally carinate, the pronotal lateral processes very robust, broad, slightly elevated, their apices a little recurved and obtusely angulate, posterior process almost horizontal, a little sinuate, scarcely passing the tegminal apex; basal area of tegmina distinctly punctate; face finely greyishly pilose.

Long. 7 mm.; breadth lat. pronot. process 5 mm.

Hab. Upper Egypt; Northern Etbai (*D. MacAlister*).

Oxyrhachis versicolor, sp. n.

Pronotum black, the frontal area, the anterior edge of the lateral processes, and a little more than half of the upper basal area ochraceous; body beneath and legs more or less ochraceous; face brownish-ochraceous; tegmina subhyaline, the veins and basal area brownish-ochraceous; pronotum more or less coarsely punctate, the lateral processes upwardly directed, distinctly curved backwardly, the apices acute, posterior process somewhat strongly sinuate, its apical area upwardly curved, not quite reaching the tegminal apex; tegmina with the basal area punctate, the veins (excluding those on apical area) finely greyishly pilose, on apical area the veins are black.

Long. 7 mm.; breadth lat. pronot. process 4-5 mm.

Hab. Aden (*J. J. Walker*).

This species was taken during the voyage of H.M.S. 'Penguin.'

Oxyrhachis bisenti, sp. n.

Pronotum and face pale fuscous brown, more or less shortly, finely, palely pilose, the apical area of posterior pronotal process considerably darker in hue; body beneath and legs ochraceous, femora (excluding apices) black or blackish; pronotum centrally, percurrently, palely carinate, the lateral processes distinctly directed upwardly, their apices a little recurved and subacute, posterior process apically recurved and a little passing the tegminal apex; basal angle of tegmina coarsely punctate, a black spot near inner apical angle.

Long. 6½–7 mm.; breadth lat. pronot. process 3–3½ mm.

Hab. Natal; Durban (*Bell-Marley*). Rhodesia; Salisbury (*Guy Marshall*). Nyasaland; Mlanje (*S. A. Neave*). Dowa District (*Dr. Lamborn*).

Named after Mr. Neave's chief native collector.

Xiphistes inermis.

Xiphistes inermis, Jacobi, in Sjöstedt Kilimandj. Exped. xii., Hom. p. 119, t. ii. fig. 7 (1910).

Jacobi described his species from a single ♂ specimen which measured "long. c. tegm. 5,5 mm." The British Museum now possesses a single female specimen, collected by H. S. Stannus at Zomba, Nyasaland, which measures 8½ mm.

Xiphistes tanganensis.

Oxyrhachis tanganensis, Buckt. Monogr. Membracid. p. 225, pl xlix. fig. 7 (1903); Melich. Wien. Ent. Zeit. xxiv. p. 294 (1905).

Hab. Tanga, E. Africa.

Xiphistes exigua.

Otinotus exigua, Buckt. Monogr. Membracid. p. 232, pl. lii. fig. 5 (1903).

Hab. Natal.

Xiphistes crassicornis, sp. n.

Fuscous brown, thickly, finely, greyishly pilose; margins of the abdominal segments paler and more ochraceous; tegmina subhyaline, the venation fuscous-brown, a small oblique fuscous-brown spot near posterior angle of the inner tegminal margin; pronotal angles very robust and prominent, obliquely directed upwardly, their apices truncate, all their margins ridged, outwardly a little sinuately narrowed near base, pronotum centrally percurrently ridged, posterior process moderately slender, rugulose, beneath centrally distinctly serrate, its apex subacute, recurved, passing the posterior angle of the inner tegminal margin; tibiæ distinctly dilated.

Long., incl. ant. pronot. proc., 8½ mm.

Hab. Mashonaland; Lesapi R. (*G. A. K. Marshall*).

A species to be easily recognized by the very robustly produced anterior pronotal angles.

Xiphistes attenuata, sp. n.

Uniformly pale brownish-ochraceous; body elongate, posteriorly attenuate; pronotum coarsely punctate, centrally percurrently carinate, the anterior angles longly, almost horizontally produced, slender, very slightly apically depressed, all the edges carinate, the posterior process slender, its apex depressed and almost reaching apices of tegmina, which are semihyaline, the venation pale brownish-ochraceous; in some lights the abdomen beneath is reflected, thus making the basal two-thirds of the tegmina to appear as of a more testaceous hue.

Long., incl. ant. pronot. proc., 7½ mm.

Hab. Mashonaland; Lesapi R. (*G. A. K. Marshall*).

A species to be distinguished by its attenuated form and the long and slender pronotal lateral angles, which are subequal in length to that of the pronotum behind them.

Genus GONGRONEURA.

Pedalion, Buckt. Mon. Membrac p 251 (1903), nom. praeocc
Gongroneura, Jacobi, in Sjostedt Kilimandj. Exped. xii, Hom. p. 119 (1910), n. nom.

Gongroneura triste.

Pedalion triste, Buckt. Mon. Membrac. p. 252, pl. lvii. fig. 5 (1903).

Hab. Cameroons.

Gongroneura ornata.

Pedalion ornatum, Buckt. Mon. Membrac. p. 252, pl. lvii. fig 6 (1903).

Hab. Cameroons.

Genus PYRGAUCHENIA.

Pyrgauchenia, Bredd, Halle Abh. naturf. Ges. xxiv. p. 126 (1900), Schmidt, Stett. Ent. Zeit. lxvii. p. 370 (1906).
Pyrgophyllium, Bredd. Soc Ent. xvii. p. 91 (1902).
Pyrgolyrium, Bredd. *loc. cit.* p 92 (1902)

Type, *P. sarasinorum*, Bredd.

It is, perhaps, better to provisionally accept Schmidt's compression of Breddin's genera as above, for the last-named entomologist queried several of his own generic fixations (*supra*). More material may possibly cause a different conclusion. On the other hand, I do not agree with Schmidt that Stål's genus *Pyrgonota* = *Hypsauchenia*, Germ.

Pyrgauchenia sarasinorum.

Pyrgauchenia sarasinorum, Bredd., Halle Abh. naturf. Ges. xxiv. p. 127 (1900).
Hypsauchenia guttiplaga, Walk. MS.
Hypsauchenia hardwickii, Walk. (nec Kirby), Journ. Linn. Soc., Zool. x. p. 183 (1868).

Brownish-ochraceous; face piceous; tegmina and legs a little paler ochraceous; tegmina with a subapical transverse fascia of five or six white spots, commencing at costal but not reaching inner margin; anterior pronotal process compressed, upwardly concavely erect at base, and then somewhat straightly continued to above the apex of tegmina, narrowed near its apex, which is strongly bilobed, the apex of each lobe laminately triangularly widened, before apex distinctly tricarinate, the carinæ at basal front distinctly paler in hue, the posterior process broadly concavely erect and compressed beyond middle, the central ridge very finely serrate, darkly coarsely punctate, on each side at base a curved, linear, longitudinal, pale ochraceous ridge.

Long. 10½ mm.

Hab. Celebes; Tondano (*Wallace*, Brit. Mus.).

This species seems to have been originally recorded by Walker as *hardwickii*, Kirby, and on subsequently noticing the error was then labelled, but not described, as *guttiplaga*.

Pyrgauchenia suberecta, sp. n.

Dull bronzy brown, the legs and basal pronotal ridges pale ochraceous. Allied to the preceding species, *P. sarasinorum*, Bredd., but much darker in coloration, the tegmina lacking the white macular fascia; the anterior pronotal process much more erect, upwardly-concave, its apex scarcely passing the apical region of the posterior process (extreme apex mutilated), posterior process coarsely punctate, but less convexly elevated before apex.

Long. 9 mm.

Hab. S. Celebes, Bua-Kraeng (*H. Fruhstorfer*).

Pyrgauchenia jugulata.

Hypsauchenia jugulata, Buckt. Trans. Linn. Soc. Lond., Zool. ser. 2, vol. ix. p. 332, pl. xxi. fig. 12 (1905).
? *Pyrgauchenia breddini*, Schmidt, Stett. Ent. Zeit. lxvii. p. 370 (1906).

Hab. Sumatra; Swlak Daras, Korinchi Valley, 3100 feet.

Buckton's description and figure represent a mutilated example in which the anterior pronotal process is mutilated.

In a complete example now before me this attains an altitude of 8 mm., and its apex is strong and longly bilobed, these lobes being subtriangular in shape, with their inner angles rounded and their outer angles acute, between their bases the process is widened and centrally a little anteriorly produced. The posterior pronotal process is also less lobately elevated than in Buckton's figure.

Schmidt's *P. breddini* appears to refer to Buckton's species, but I have not seen his type.

Pyrgauchenia kinabalense.

Pyrgophyllium? kinabalense, Bredd. Soc. Ent xvii. p. 91 (1902).

Black; femora (excluding bases), margins of tibiæ and bases of tarsi ochraceous; pronotal carinæ and base of posterior pronotal process pale ochraceous; tegmina with a distinct white spot at posterior angle of inner margin of tegmina; anterior pronotal process erect, a little directed forwardly, moderately compressed, the apex inwardly subacutely produced, the central carinæ ochraceous and very finely serrate, posterior process compressed, gibbously convex, the apex reaching the posterior angle of inner tegminal margin.

A species near the Sumatran *H. jugulata*, Buckt.; but, although a large series of specimens are now before me, I am in doubt as to whether I have an example showing the true apex of the anterior pronotal process. From *H. jugulata* it may at once be separated by the very much more elevated posterior pronotal process, the shorter anterior pronotal process, and its much smaller size.

Long. 6½ mm.

Hab. Borneo; Mt. Kina Balu (*J. C. Moulton*). Sumatra; Swlak Daras, Korinchi Valley.

Var. *a.*—Tegmina distinctly mottled with ochraceous.

Var. *b.*—Tegmina brownish-ochraceous, the pale ochraceous markings to pronotum less distinct.

Var. *c.*—Dull ochraceous, tegmina finely mottled with brownish.

Pyrgauchenia colorata, sp. n.

Black; anterior carinæ and central longitudinal ridge to the pronotum, costal margin and claval area to the tegmina, and the legs more or less brownish-ochraceous, a white transverse fascia (divided by the dark veins) on posterior area of the tegmina; anterior pronotal process elevated and recurved (its apex mutilated in the three specimens now before me), posterior process near middle, very strongly and subangularly elevated, its apex slightly passing the posterior angle of the inner tegminal margin, the whole pronotum more or less distinctly, thickly, finely punctate.

Long. 6½ mm.

Hab. Borneo; Mt. Kina Balu (*J. C. Moulton*).

Apart from the different coloration, this species is to be separated from *P. kinabalense* by the narrower and much more strongly and straightly erected protuberance of the posterior pronotal process.

HYBANDOIDES, gen. nov.

Allied to the Oriental genus *Hybanda*, Dist., but differing in having the anterior pronotal process directed forwardly, compressed, and not apically lobed or foliaceous, the posterior pronotal process slender, laterally and centrally carinate, attenuated towards apex and about reaching the posterior angle of the inner tegminal margin; tibiæ moderately dilated.

Type, *H. horizontalis*, Dist.

Hybandoides horizontalis, sp. n.

Head, pronotum, body beneath, and legs pale fuscous brown, somewhat thickly, finely, more palely pilose; tegmina brownish-ochraceous, the apical cells paler, more greyish and speckled with dark fuscous; anterior pronotal process broad, compressed, directed almost horizontally forward, the apex broad, roundly truncate and slightly recurved, the posterior process slender as described in the generic diagnosis; in some specimens there are indications of some very small greyish spots on the tegmina; tibiæ distinctly dilated.

Long. 8½ mm.

Hab. Borneo; Mt. Kina Balu (*J. C. Moulton* and Coll. Buckton).

In this species the anterior pronotal process varies considerably in length, in some instances being so short as to suggest another species; but in the series now before me a gradual gradation is observable.

Centrochares horrificus.

Centrotus horrificus, Westw. Proc. Zool. Soc. Lond. 1837, p. 130; Guér. Mag. Zool. sér. 2, iii., Ins. pl. lxxxii. (1841).
Pterygia horrifica, Walk. List Hom. ii. p. 500 (1851); id. iv. t. iv. figs. 4 & 5 (1852).
Centrochares horrificus, Stål, Œfv. Vet.-Ak. Forh. 1870, p. 731.
Pterygia spinula, Buckt. Mon. Membrac. p. 72, pl. xii. fig. 4 (1901).

Hab. Philippines; Baco River, Mindoro (*J. J. Mounsey*).

Buckton's type of *P. spinula* is founded on a mutilated specimen.

Centrochares ridleyanus, sp. n.

Cinnamon-brown; tibiæ and tarsi ochraceous; pronotal lateral angles longly, obliquely, forwardly and a little upwardly produced, their margins serrate, their disks finely tuberculate, their apices broadened and spatulate, externally truncate; disk of pronotum percurrently carinate and serrate, as is also the frontal lateral margins, posterior pronotal process conically upwardly produced near base; its margins longly serrate, more broadly and upwardly produced near apex, with its margins also longly serrate.

Long. 4 mm.

Hab. Malay Peninsula; Singapore (*H. N. Ridley*).

Allied to *C. horrificus*, Westw., from which it differs by its smaller size, the narrower and more erect subapical lobe to the posterior pronotal process, &c.

Genus MICREUNE.

Micreune, Walk. Journ Linn. Soc. Lond, Zool. i. p. 94 (1856).

Micreune formidanda.

Micreune formidanda, Walk. Journ. Linn Soc. Lond, Zool. i. p 94 (1856)
Micreune quadrilinea, Walk. MS.

Hab. Singapore; Borneo.

A specimen labelled by Walker *M. quadrilinea* from Borneo is in the British Museum, but I can find no description of the synonym.

XLI.—*On some Enigmatical Names in Conchology and Pycnogonology.* By the Rev. THOMAS R. R. STEBBING, M.A., F.R.S.

FOR reasons which they think satisfactory, some naturalists give references so curtly that those who wish to consult the works referred to find the task exceedingly troublesome. For instance, in a recent volume *Neritine*, Lamarck, 1809, is rejected in favour of a later name, presumably on the ground that *Neritine* is only a French word; but neither is that stated nor is any clue given as to which of Lamarck's writings it is that contains the name in question. Authors in general have adopted *Neritina*, Lamarck, 1822, ignoring the claim of *Theodoxus*, de Montfort, 1810. Gistel, in his part of the 'Handbuch der Naturgeschichte,' p. 553 (1850), after his lordly fashion, without vouchsafing any reason for the change, writes "Chernites, Nob.—Der Autoren Neritina."

Leaving the elusive *Neritine* to its fate, I turn to the generic name *Panope*, familiar to carcinologists through its adoption by Leach for a genus which had already been named *Cyamus* by Latreille in 1796. Its use in conchology was precluded, unless that use antedated Leach's amphipod genus so named in 1813. Lamarck, indeed, refers in French to "Les Panopes" in 1807, but he is evidently alluding to the genus *Panopea* established earlier in the same year by Menard de la Groye, also in the Annales du Mus., Paris. Researches are a little complicated, seeing that Scudder, 'Nomenclator Zoologicus,' p. 231, gives "Panopæa Mén. Moll. 1807. A." and "Panopea Mén. Moll. 1807. S.," but in the Supplemental Index "Panopea Ménétries. Ann. Mus. ix, p. 135. 1807. Moll., Biv."—the last a useful reference but with the regrettable introduction of the name Ménétries in place of Menard de la Groye. It is due, however, to J. Gwyn Jeffreys to say that in 1865, in his 'British Conchology,' vol. iii. p. 75, he protested against the several variations of the name as opposed to "the original and correct one," *Panopea*, which he himself had given. Nevertheless, in his fifth volume, p. 192 (1869), he refers to vol. iii. p. 74, the following supplemental remark, "PANOPEA. *Panope*, Mén.," probably by his *Panope* only intending to give the French form of *Panopea*, but, if so, giving it wrongly, since de la Groye's French version of the name is Panopée. It is possible that Jeffreys may have been misunderstood as giving *Panope* for a correction of his earlier *Panopea*.

The case of *Rissoa* is at first sight rather less simple. Being surprised by the change of so familiar a name into *Rissoia*, I desired to learn the reason for the alteration. An early work on natural history by Risso is dated 1810. The genus *Rissoa* was named after him in 1814. It did not seem probable that the name was void in conchology through any earlier use of it, nor has any such use been suggested. It appears that Bronn, in 1849, by way of emendation introduced the form *Rissoia*, without understanding that he was thereby creating a new generic name. It was adopted by Fischer ('Manuel de Conchyliologie,' 1881–1887), in which, at p. 720, he records "Rissoia, Fréminville, em. 1814 (*Rissoa*), synonymie, Cingula (Fleming, 1828)." The emendation was apparently unknown to Jeffreys, and is unnoticed in the 'Manual of the Mollusca' by Woodward and Tate. In 1859 Chenu's 'Manuel de Conchyliologie,' vol. i. p. 306, retains "Rissoa, Fréminville, 1814," subjoining "Rissoaria, Agassiz, 1846," as a synonym. Reference to the work of Agassiz, 'Nomina systematica Generum Molluscorum,' edited by Gray, Menke, and Strickland, reveals the following entries:—

Rissoa, Frém. Bull. Soc. Phil. iv. 1814.
Rissoaria, Frém. Bull. Soc. Phil. 1814.

Pursuing the quest, at p. 7 of the volume indicated we find "Description des Coquilles univalves du genre Rissoa de M. de Fréminville; par M. A.-G. Desmarets," followed by the statement "Ce genre, dont l'établissement a été jugé nécessaire par M. C. de Fréminville . . . porte le nom de M. Risso." Then the definition of the genus is given by Anselme Gaetan Desmarets (or Desmarest), to whom, therefore, the genus should be ascribed, and not to the Baron de Fréminville, unless the latter did something more than suggest its name. But of *Rissoaria* not the least trace could be found in the volume cited by Agassiz. It is, perhaps, nothing but an ampler emendation in advance of *Rissoia*. As a matter of curiosity, the treatment of *Rissoa* by Johannes Gistel deserves mention. In his 'Naturgeschichte des Thierreichs,' 1848, at p. x he indicates "Rissoa (Frém. Gasterop. R. striatella, O. Fabr.; Chiajo in Memorie V.; Quoy: Isis 1834); Apanthausa, N." But on p. 169, after Paludina achatina, he introduces the remark "Hieher das Genus *Melania* (dessen Name in Hydrognoma, mihi, zu ändern) und *Rissoa* (in Anatasia, mihi, umzuwandeln." As between *Apanthausa* and *Anatasia*, the latter might well claim priority, since it occurs in the body of the work, while *Apanthausa* is in the separate pagination of the prefatory portion, which, though first in arrangement, is naturally last in order of production. That *Apanthausa* was only a slip of the pen is the more likely, as in the 'Handbuch der Naturgeschichte,' p. 554 (1850), he gives only *Anatasia*, with no allusion to *Apanthausa*. Whatever the change intended, he evidently feels that it is unnecessary for so eminent a naturalist to vindicate or even explain its necessity.

With regard to the Pycnogonida, I find a procedure of my own inculpated (or, at least, lamented) by Dr. Loman in a recent essay, which is on other accounts of much value. But on the point in question he does not seem to me to adopt a sound view. In 'Knowledge,' vol. xxv. no. 202 (1902), at p. 187 I pointed out that Latreille in 1804 instituted the genus *Phoxichilus*, assigning to it the single species *Pycno-*

gonum spinipes, O. Fabricius, which had since been recognized as belonging to *Pseudopallene*, Wilson, 1878. The result has been accepted by some good authorities that *Pseudopallene* becomes a synonym of *Phoxichilus*. Dr. Loman disputes this, on the ground that Latreille subsequently changed his definition of *Phoxichilus*, and that the specimen with which he was dealing was, in fact, a *Pallenopsis* and not a *Pseudopallene*. But this interesting determination does not alter the fact that *Phoxichilus* was originally established for *P spinipes* and cannot be separated from it. Dr. Loman's endeavour to effect this divorce only adds to the confusion which he so much deplores. As to the genus *Chilophoxus*, which I deemed it necessary to name in 1902, it is proper to mention that Canon Norman in 1908 made it a synonym of *Endeis*, Philippi, 1843, a view declined by Dr. Loman but endorsed by Dr. Calman in this current year (1915). It is not, however, within the scope of this present paper to discuss the conflicting arguments of these distinguished authorities.

XLII.—*Notes and Synonymy of Hymenoptera in the Collection of the British Museum.* By Geoffrey Meade-Waldo, M.A., Claude Morley, F.Z.S., and R. E. Turner, F.Z.S.

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II.

The following paper may be considered a continuation of that published in Ann. & Mag. Nat. Hist. (8) xiv. pp. 402–410 (1914). As on that occasion, most of the material dealt with is contained in the Cameron Collection, now the property of the British Museum.

Family SCOLIIDÆ. By G. Meade-Waldo, M.A.

Scolia (Discolia) erivanensis, Rad. (1880), subsp. **quettaensis**, Cam.
=*Scolia quettaensis*, Cam. (1907), ♂ ♀. Quetta.

Differs from the typical form in having segments 1 and 2 of the abdomen ferruginous.

Scolia histrionica, F., var. **nigrobimaculata**, Cam.=*Scolia nigrobimaculata*, Cam. (1908). Deesa.

„ (*Discolia*) *thyatira*, Cam.=*Discolia patara*, Cam. (1902). Borneo.

Scolia (*Discolia*) **westermanni**, Sauss. (1858) = *Scolia rugifrons*, Cam. Khasia.

„ „ **ruficornis** (F.) (1793) = *Discolia bonæ-spei*, Cam. (1905). S. Africa.

„ „ **sikkimensis**, Bingham (1896) = *Discolia erythropoda*, Cam. (1903). Khasia.

„ „ **venusta**, Smith (1855) = *Discolia erythrotrichia*, Cam. (1904). Simla.

„ „ *desidiosa*, Bingham = *Discolia ergenna*, Cam. (1902). Borneo.

Dielis rubromaculata, Smith (1855) = *Dielis borneana*, Cam. (1902). Borneo.

„ **transvaalensis**, Cam. (1910) = *Dielis madonensis*, Buysson (1910). S. Africa.

Family PSAMMOCHARIDÆ. By R. E. Turner, F.Z.S.

Pepsis centralis, Cam. (1892) = *Pepsis margaritæ*, R. Lucas (1894). Panama.

„ **purpurascens**, Smith (1855). Tapajoz = *P. fuscipennis*, Smith, ♀ (1873). Amazons, Para.

„ **montezuma**, Smith (1855), ♀. Centr. Amer. = *P. occidentalis*, Cam., ♂ (1893).

„ **cinctipennis**, Mocs. (1855), ♀ = *P. guatemalensis*, Cam. (1892), ♀.

„ **strenua**, Erichs. (1848), ♀. Demerara = *P. tinctipennis*, Smith (1873), ♀. Para. Var. with apical joints of antennæ yellow.

Hemipepsis dedjas (Guerin, 1848). Africa = *Mygnimia imperialis*, Smith (1855), ♀.
= *Mygnimia bidentata*, Sauss. (1892), ♂.

„ **spectrum** (Smith, 1855), ♂. Centr. Africa = *Priocnemis hirsutus*, Sauss. (1892), ♂.
= *Mygnimia depressa*, Sauss. (1892), ♀.

„ **hottentota** (Sauss. 1892), ♀ = *Mygnimia fallax*, Sauss. (1892), ♂.

„ **ocellata** (F.). This is *Sphex ocellata*, F., of which the type is in the Banks Collection in the British Museum.

„ **momentosa** (Smith, 1873), ♂ = *Salius hirticaudis*, Cam., ♂. Borneo.

„ **vindex** (Smith, 1855), ♀. Natal = *Mygnimia megæra*, Smith (1855), ♂, *M. tisiphone*, Smith (1855), ♀, in poor condition, and *M. regina*, Sauss. (1892). Kohl (Hymen. Südarabiens, 1906, p. 97) gives *M. tisiphone*, Smith, as a *Chyphononyx*, evidently a wrong identification.

Mygnimia mexicana, Cress. (1867), ♀ =*Salius rogersi*, Cam. (1892), ♀. Mexico. The species identified by Cameron as "*Salius mexicana*" is not that species.

Chyphononyx nigrita (F.)=*Sphex nigrita*, F., the type of which, from Malabar, is in the Banks Collection; there are specimens from Uganda in the British Museum Collection.

Chyphononyx optimus (Smith, 1855). Africa=*Salius* (*Chyphononyx*) *melanocerus*, Cam. (1910).

„ **bretoni** (Guérin), ♀ nec ♂ =*Pompilus exasperatus*, Smith, ♀, Congo, *Pepsis xanthocerus*, W. F. Kirby (nec Dahlb.), ♀, and *P. atlanticus*, W. F. Kirby, ♂ (1884), Cape Verdes.

The ♀ described by W. F. Kirby as *Priocnemis atlanticus* is *Batazonus fuliginosus*, Klug. *Sphex flavicornis*, F., which Dalla Torre queries as *C. bretoni*, is nearly allied but distinct; the type is in the Banks Collection at the British Museum.

Chyphononyx antennata (Smith, 1855), ♀ =*Chyphononyx antennata*, Sauss. (1892), ♀.

It is a curious fact that this S. African species should have been given the same specific name by both authors. Smith described it as *Mygnimia*.

Chyphononyx peregrinus (Smith, 1875), ♀ =*Salius saturnalis*, Cam., ♂. Khasia Hills, Calcutta.

Cryptochilus ferrugineipennis (Hal. 1836), ♀ =*Pompilus dumosus*, Spin. (1851), and *Pepsis ferrugineipennis*, Dalla Torre and Lucas. S. America.

Cryptochilus ridleyi (Cam.), ♂ =*Salius anthracinus*, Bingh. (nec Smith). Borneo.

In this species the ♂ has the tarsal ungues bifid, as in *Chyphononyx*, and the ♀ unidentate, as in *Cryptochilus*.—N.B. *Mygnimia anthracina*, Smith (1855), is a *Hemipepsis*.

Cryptochilus valentulus (Bingh. 1896), ♀ =*Salius geminus* (Bingh. 1896), ♀. N. India.

„ **decipiens** (Smith, 1855), ♀ = *Pompilus subviridis* (Smith, 1855), ♂. Natal.

„ **sericosoma** (Smith, 1855), ♀. Sumatra=*Salius sostratus*, Cam., ♀, and *S. brookii*, Cam., ♂. Borneo.

„ **bipartitus** (Lep.)= *Calicurgus bipartitus*, Lep. (1845). Bingham (Fauna Brit. India, Hym. i.) gives this species and *Priocnemis peregrinus*, Smith, as synonyms of "*Salius bipartitus* (Lep.)." They belong to different genera.

Prionocnemis omiltensis (Cam. 1891), ♀, described as *Salius*= *Salius trifasciatus*, Cam. (1891), ♂. Mexico.

„ **xenos** (W. F. Kirby, 1889), ♂=*Ichneumon huttoni*, W. F. Kirby (1884), ♀. New Zealand.

„ **orbiculatus** (Smith, 1862), ♂, described as *Agenia*= *Pompilus* (*Prionocnemis*) *cincticornis*, Cress. (1867). Mexico.

The following Tasmanian species belong to **Prionocnemis**:— *Calopompilus aliciæ*, Turner (1915), *C. xanthochrous*, Turner (1915), and *C. connectens*, Turner (1915).

Pseudagenia albipalpis (Cam.)=*Pompilus parvispinosus*, Cam. Borneo.

„ **danaë**, Bingham (1896)=*Pseudagenia erythropoda*, Cam. Khasia.

„ **micans** (Fabr. 1804). S. Amer.=*Pseudagenia pulchricornis*, Cam. (1911), ♀. Brit. Guiana.

„ **comparata** (Smith, 1873), ♀. Amazons=*Agenia femorata*, Smith (*Pseudagenia smithii*, D. Torre).

„ **nobilitata** (Smith, 1864), ♂. Brazil=*Agenia gloriosa* (Smith, 1873), ♂, and *Salius aureodecoratus* (Cam. 1911). Brit. Guiana.

Genus **Batozonus**, Ashm. 1902=*Heteronyx*, Sauss. 1887 (sed nom. præocc.). Type *B. madecassus*, Sauss.

Batozonus unifasciatus, Sm., ♀, 1855=*Pompilus multipictus*, Sm. 1879, ♂.

„ **madecassus**, Sauss., ♀, 1887=*Cyphononyx* (*Schistonyx*) *decorata*, Sauss., ♂, 1891.

„ **fuliginosus**, Klug, ♀, 1834=*Pompilus festivus*, Klug, ♂, 1834,
=*Pompilus bretoni*, Guér. 1843, ♀ (nec ♂)=*Pompilus sepulchralis*, Sm., ♀, 1879,
=*Pompilus iridipennis*, Sm., ♀, 1879=*Pompilus vindicatus*, Sm., ♀, 1855,
=*Anoplius o'neili*, Cam., ♂=*Pompilus solanus*, Kohl., ♀, 1893,
=*Prionocnemis atlanticus*, Kirby, 1884, ♀ (nec ♂).

„ **orientalis** (Cam.), ♂, 1891 (as *Ceropales*)=*Pompilus bioculatus*, Bingh., ♀.
=*Pompilus citherus*, Cam., ♂. Dark-winged variety of ♀=*Pompilus bracatus*, Bingh.=*Pompilus subfervens*, Cam.=*Salius malayanus*, Cam.

„ **capensis**, Dahlb., ♀, 1843=*Pompilus vindex*, Sm., ♀, 1879 (nec ♂).
=*Pompilus ancyloneurus*, Cam., ♀.

To this genus also belong *Pompilus vespoides*, Sm., ♀, 1868, and *Pompilus trichrous*, D. T. = *Pompilus tricolor*, Sm., ♂, 1868; both Australian, but not sexes of one species.

Batozenus (?) ornatus, Klug, ♂, 1834 = *Pompilus anticus*, Klug, ♀, 1834.
= *Pompilus fertoni*, E. Saund. 1901, ♀ (nec ♂).

This species is not quite a typical *Batozonus*, but is intermediate between that genus and *Episyron*.

Psammochares (Episyron) natalicolus (Dalla Torre, nom. nov.) = *Pompilus fervidus*, Smith (1879, nec 1873) = *Anoplius pulchrihirtus*, Cam. S. Africa.

Psammochares (Episyron) rufipes (L.), var. **funereipes**, Costa = *Pompilus maculifrons*, Smith, ♂ (1873), Japan, and *Pompilus arrogans*, Smith, ♀. *Pompilus erebus*, Smith (1873), is a black variety of this species.

Psammochares 4-punctatus (Fabr.) = *Pompilus accensus*, Bingh. Japan. ? MS.

Aporoideus mitis (Smith), ♀. Cawnpore = *Pompilus buddha*, Cam. Bombay.

Paracyphonyx pedestris (Smith, 1855), ♀ = *Pompilus orodes*, Cam. = *P. hero*, Cam., ♂ = *Pompilus rothneyi*, Cam., ♀, is a variety. An Indian species.

Paracyphonyx frustratus (Smith, 1879). S. Africa = *Anoplius gradatus*, Cam., ♂, and *Anoplius labialis*, Cam., ♂.

Pompilus ignitus, Smith (1855), ♀. S. Africa = *Pompilogaster erythrura*, Cam., ♀. Transvaal.

Sericopompilus neotropicalis (Cam. 1893), ♀ = *Pompilus guatemalensis*, Cam., ♂ (1893).

Notocyphus rixosus, Smith (1855), ♀. Brazil = *Ceropales chiriquensis*, Cam., ♀ ♂ (1891). Panama.

The following Brazilian species are all referable to **Notocyphus**:—*Agenia lætabilis*, Smith (1873), ♀, *A. conspicua*, Smith (1873), ♀, *A. ordinaria*, Smith (1873), ♀, *A. multipicta*, Smith, ♂, *Ceropales fumipennis*, Cam., ♂, *C. lugubris*, Smith, ♂, *C. crassicornis*, Smith (1864), and *C. smithii*, Dalla Torre (= *crassicornis*, Smith (1873)).

Family SPHEGIDÆ. By G. Meade-Waldo, M.A.

Bembex melancholica, Smith (1856). Sumatra = *Bembex khasiana*, Cam. Khasia. The Indian specimen is a variety of Smith's species.

Bembex niphonica, Smith (1873). Japan = *Bembex picticollis*, Mor. (1889). China.

Palarus latifrons, Kohl (1883). S. Africa=*Palarus curvilineatus*, Cam.

Oxybelus arabs, Lep. (1845). N. Africa=*Oxybelus forticarinatus*, Cam. Deesa.

Crabro fulvopilosus, Cam., ♀. Khasia=*Crabro ctenopus*, Cam., ♂. Sikkim.

Astata orientalis, Smith (1856). India=*Astata interstitialis*, Cam. Deesa.

Tachytes natalensis, Sauss. (1854). S. Afr.=*Liris nigropilosellus*, Cam. (1910).

Ampulex nigrocærulea, Sauss. (1892). S. Afr.=*Ampulex jansei*, Cam. (1910). Transvaal.

„ **(Rhinopsis) denticollis** (Cam.)=*Dolichurus denticollis*, Cam. (1910). S. Afr.

Family EUMENIDÆ.

Odynerus (Symmorphus) albomarginatus, Sauss.=*Symmorphus horni*, Cam. Colorado.

Family APIDÆ.

Halictus latibalteata (Cam.), ♀=*Nomia latibalteata*, Cam., ♀. Transvaal.

Halictus *albofasciatus*, Smith (1879), ♀=*Paranomia broomi*, Cam., ♀. Transvaal.

Paranomia albolineata, Cam., and *P. tricolor*, Cam., are both referable to **Halictus**.

Family ICHNEUMONIDÆ. By Claude Morley, F.Z.S., F.E.S.

Subfamily Ichneumoninæ.

Amblyteles *opiparus* (Cam.)=*Ichneumon opiparus*, Cam., from Mexico, is a female closely allied to *Amblyteles armatorius*, Forst.

Diadromus *erythrostomus* (Cam.)=*Stilboscopus erythrostomus*, Cam. (Trans. Amer. Ent. Soc. xxxiv. (1908) p. 244).

Subfamily Cryptinæ.

Acanthoprymnus, Cam. (Entom. 1905, p. 249, with type *violaceipennis*, p. 250, ♀ only).

A genus easily known by "there being only three abdominal segments and by the last being stoutly spined laterally"=*Camptolynx*, Cam. (Berl. Ent. Zeit. 1910, p. 252, with type *fuscipennis*, Cam., p. 253, ♂ only). I have examined his three species of the latter name in the Berlin Kgl. Mus., and find them to belong to the Hemitelini; they are common throughout Southern India.

Subfamily PIMPLINÆ.

Thymaris macrophthalma (Cam.) = *Rugania macropthalma*, Cam., ♀, from Kuching.

Macrogaster, Brullé, 1846, et Morl. Fauna Brit. India, Ichn., 1913 = *Siphimedia*, Cam. Journ. St. Br. R. As. Soc. xxxvii. (1902) p. 43.

Lampronota caligata, Grav. 1829 = *Chalinocerus mancus*, Ruthe, Stett. Ent. Zeit. xvi. (1855) p. 82, ♂ ♀.

,, **melancholica**, Grav. 1829 = *Chalinocerus defectivus*, Ruthe, *l. c.* p. 80.

Syzeuctus lepidus (Cam.).—*Lissonota lepida* (type labelled "*lepcha*," sic), Cam. Zeits. Hym. Dip. 1908, p. 43, ♂ = *Syzeuctus compressus*, Morl. Faun. Brit. Ind., Ichn. 1913, p. 235, ♀.

Syzeuctus indicus (Cam.).—*Cryptus indicus*, Cam. Manch. Mem. 1897, p. 15; *cf.* Entom. 1914, p. 25 = *Mesoleptus annulipes*, Cam. Manch. Mem. 1900, p. 103, ♂ = *Tanera annulipes*, Cam. Spolia Zeyl. 1905, p. 141, ♀ = *Syzeuctus annulipes*, Morl. Faun. Brit. Ind. 1913.

Lissonota flavopicta, Smith, Trans. Ent. Soc. Lond. 1878, p. 4, ♂ ♀ = *Mesoleptus sybarita*, Cam. Manch. Mem. xlii. pt. i. 1898, p. 32, ♂ = *Lissonota rubriplagiata*, Cam. Trans. N. Zealand Instit. xxxiii. 1901, p. 106, ♀.

Lissonota albopicta, Smith, Trans. Ent. Soc. Lond. 1878, p. 4, ♂ = *L. tinctipennis*, Cam. Manch. Mem. xlii. pt. i. 1898, p. 28, ♀ = *Mesoleptus comparatus*, Cam. *lib. cit.* p. 33, ♂.

Both the last two species have circular spiracles; the former is much the more slender, with discally flavous hind coxæ and less conspicuous pleural markings.

Phytodiætoides spinipes, Cam.; *cf.* Ann. & Mag. Nat. Hist. xiv. 1914, p. 409. I now know the ♂ of this species, which differs only sexually.

Eugalta, Cam. Manch. Mem. 1899, p. 135 = *Pseudeugalta*, Ashm. Proc. U.S. Nat. Mus. 1900, p. 55, of which the latter is founded solely upon an alar character, which, I find, varies in the wings of a single specimen.

Eugalta punctulata, Cam. Manch. Mem. 1899, p. 142 = *Bathymeris longipes*, Cam. Entom. 1906, p. 251.

Xylonomus elizabethæ, Bingh. Journ. Bombay Nat. Hist. Soc. 1898, p. 116 = *Cyanoxorides* [Journ. St. Br. R. As. Soc. 1903, p. 140] *albolineatus*, Cam., from Borneo.

"*Pimpla*" *gayi*, Spinola, Gay's Hist. fis. Chile, Zool. vi. 1851, p. 502, belongs to the Labenides; my reference of it (Revis. Ichn. iii. p. 141) to the Xorides was founded upon insufficient material.

Endurus, Rond. Bull. Soc. Ent. Ital. 1896, p. 66 = *Arthula*, Cam. Manch. Mem. 1900, p. 110.

"*Campoplex*" *calamiæ*, Cam. Proc. Linn. Soc. N. S. Wales, xxvii. 1912, p. 189, belongs to the genus *Acœnitus* (sensu lato).

Subfamily TRYPHONINÆ.

Dyspetes prærogator, Linn. = *Delomerista erythrostoma*, Cam., ♂, from Japan.

Erromenus melanonotus (Grav.).—*Tryphon melanonotus*, Grav. ii. 1829, p. 269, ♀ = ? *Trichocalymma plebejum*, Wold. Bull. Ac. Petrograd, 1877, p. 456, ♂.

"**Tryphon**" **intermedius**, Grav. *lib. cit.* p. 216, ♀ = forte *Monoblastus exstirpatorius*, Grav. *l. c.* p. 213 : var. *areola alarum obsoleta*.

Diplomorphus thoracicus, Giraud, Ann. Soc. France, 1871, p. 409, is most closely allied in the Palæarctic fauna to *Labrossyta*; the basal segment is subsessile, the wings infumate and claws not pectinate; Dalla Torre left it among his genera sedis incertæ. I know nothing of Kriechbaumer's two species.

Perilissus longicornis (Cam.).—*Silavoga longicornis*, Cam., from the Transvaal, is a typical species of this genus, extremely closely allied to *P. pallidus*.

Neleothymus, Först. Verh. pr. Rheinl. 1868, p. 200.—According to Ruthe's collection, this appears to be a subgenus of *Euryproctus*. *Cf.* post.

Megatrema albopilosa, Cam. Zeits. Hym. Dipt. 1907, p. 469, ♂ = *Seticornuta albicalcar*, Morl. Faun. Brit. Ind., Ichn., 1913, p. 310, ♀.

Polyclistus femoralis, Fourc. et Grav. = *Exochus fuscipilosus*, Cam., ♂ = *Plesioexochus rufipes*, Cam., ♀.

Cerda fuscipennis, Cam. Trans. Amer. Ent. Soc. xx. 1904, p. 255, belongs to the Exochides, and is in no way related to *Protarchus*, as stated by Cameron.

Subfamily OPHIONINÆ.

Nelcothymus rufidornatus, Cameron (who queries the genus), Invert. Pacif. i. 1905, p. 103, is a true species of the genus **Cremastus**, Grav.

Cremastus audax, Cresson = *Porizon audax*, Cress. Trans. Amer. Ent. Soc. iv. 1872, p. 174, ♂. "Four specimens"—in the British Museum are four specimens—"from Texas, Belfrage," of which two are ♀ ♀, differing only sexually in having the terebra about as long as the basal segment. The hind femora are stout, approaching those of *Pristomerus*, but with no tooth.

Cremastus orbitalis, Cress. = *Porizon orbitalis*, Cress. *fol. cit.*, ♂ ♀. I have not seen the type, but a pair was sent to Rev. T. A. Marshall by Riley, "ex collection Belfrage."

Cremastus hyalinipennis, Cress. = *Porizon hyalinipennis*, Cress. *fol. cit.*, ♂ ♀. "Four specimens"—four are in the British Museum, of which one is a ♂—"Texas, Belfrage."

Cremastus stigmaterus, Cress. = *Porizon stigmaterus*, Cress. *fol. cit.*, ♂ ♀. Four of the "eight specimens" are in the British Museum.

Cremastus facialis, Cress. = *Porizon facialis*, Cress. *lib. cit.* p. 175, ♂ ♀. A ♀ and two ♂ ♂ of the original "several specimens" are in the British Museum; and two more from "Collection Belfrage" are there, ex coll. Marshall.

Cremastus macer, Cress. = *Porizon macer*, Cress., *fol. cit.*, ♂ ♀.

" **delicatus**, Cress. = *Porizon delicatus*, Cress. *lib. cit.* p. 176, ♂. The unique specimen is in the British Museum.

Tarytia *spilopus* (Cam.) = *Diocles spilopus*, Cam., ♀, from Pretoria.

" *basiornata* (Cam.) = *Diocles basiornatus*, Cam., ♀ (type; ♂ co-type), from Pretoria.

Cremastus verimaculatus (Cam.) = *Hymenobosmina verimaculata*, Cam. Proc. Linn. Soc. N. S. Wales, xxxvi. 1911, p. 336, ♂ ♀. A true *Cremastus*, Grav.

Cremastus variiventris, Cam. = *Diocles variventris*, Cam., of which are three ♂ ♂ in the British Museum all labelled "Type" by its author!

Ricrena pallidipennis, Cam. Ann. S. Afric. Mus. v. 1906, p. 104, is a Cremastid.

Pimplomorpha, Cam. (Ann. S. Afric. Mus. v. 1906, p. 95), with the type-species *P. trilineata*, fol. cit.—and *P. nigrornata*, *P. flaviceps*, and *P.* (labelled alternately "*Androna*") *flaxidorbitalis*,—is Cremastid.

Xanthocampoplex *nigromaculata*, Cam. = *Zachresta nigromaculata*, Cam. Ann. & Mag. Nat. Hist. xx. 1907, p. 13; Faun. Brit. Ind., Ichn. 1913, p. 465, ♀ = *Xanthocampoplex orientalis*, Morl. *l. c.* p. 445, ♂ ♀. The spiracles are elongate.

Zachresta *oneili* (Cam.) = *Campoplex oneili*, Cam. Rec. Albany Mus. i. 1905, p. 315, ♀, from Cape Colony.

"*Charops*" *bimaculata*, Ashm., ♀, from Grenada, and "*Charops*" *perornatus*, Cam. Journ. R. Agric. Soc. Demerara, i. 1911, p. 183, both have circular spiracles!

Campoplex japonicus, Cam. Entom. 1906, p. 99, ♀ = *C. lapponicus*, Holmgr., ♀, differing only in the slightly broader areolet of the type specimen.

"*Campoplex*" *divisus*, Cress.—The specimens recorded from Mexico by Cameron (Biol. Centr.-Amer. 1886, p. 306) have circular spiracles.

Haristaeus nigrifrons, Cam., described from Mendoza, appears to be congeneric with the same author's *Pimplomorpha.*

Casinaria *crassiventris* (Cam.) = *Campoplex crassiventris*, Cam. Ann. S. Afric. Mus. v. 1906, p. 93: a co-type ♀ in the British Museum compared.

Omorga longiceps, Cam., is a typical species of this genus, allied to *O. microstiota*, Grav.

Omorga *rivalis*, Cress. Trans. Amer. Ent. Soc. iv. 1872, p. 173; not a *Limnerium*, s. s.

Omorga polynesialis, Cam. Trans. Ent. Soc. Lond. 1883, p. 191, ♀ (? et ♂).

Omorga fugitivus (Hal.) = *Campoplex fugitivus*, Hal. Trans. Linn. Soc. Lond. xvii. pt. 3, 1836, p. 318. The ♂ type is very like *Omorga ensator*, Grav.

"*Campoplex*" *meridionalis*, Ashm. Journ. Linn. Soc., Zool. 1894, p. 139, ♂ ♀, from St. Vincent. The ♂ type in the British Museum has circular spiracles, and appears to be a species of the genus **Omorga**, Thoms.

Angitia maculipes (Cam.) = *Enytus maculipes*, Cam. Invert. Pacif. i. 1905, p. 132. A true ♀ of *Angitia*, Thoms., with no areolet.

Angitia blackburni, Cam. *loc. cit.* p. 192, ♀ (? et ♂).

Angitia hawaiiensis, Cam. Manch. Mem. v. 1886, p. 271.

Angitia *annulipes* (Cress. et Ashm.) = *Limneria annulipes*, from the same source, certainly belongs to *Angitia*, Thoms.

Nepiera africana (Cam.) = *Limneria africana*, Cam. Rec. Albany Mus. i. 1904, p. 175, ♂. This I consider to belong to the genus *Nepiera*, Thoms.; two ♀ ♀ in the British Museum are also labelled by Cameron "*Diadegma fasciannulata*, Cam. Type. Pretoria," and "*Limnerium stellaboschense*, Cam. Cape Colony."

"*Tryphon*" *obstructor*, Smith, Trans. Ent. Soc. Lond. 1878, p. 4, from New Zealand, is a Campoplegid, and, I think, a *Meloboris*, Thoms. Both the type and variety with the hind coxae black above are ♂ ♂ and difficult to place with certainty.

[Of the other two Tryphoninae mentioned, *l. c.* p. 3: *Scolobates varipes* = *Bassus laetatorius* (*cf.* Morl. Ichn. Brit. iv. 1911, p. 82), and *S. intrudens* = a remarkable form of Campoplegid (*cf.* Revis. Ichn. iii. 1914, p. 126), with circular metathoracic spiracles.]

Limnerium *fugitivum* (Say).—Specimens received through Riley from the United States, labelled "*fugitiva*, Say," belong to *Limnerium*, sensu Thoms.

Limneria garrulum, Cam. Rec. Albany Mus. i. 1905, p. 315, judging solely from the type (in poor condition), is a **Nemeritis**, sensu Thoms.

Helictes *longipes* (Cam.), from Mexico, was described under the genus *Paipila*.

Talorga spinipes, Cam. (Entom. xliv. 1911, p. 64).—The type is a ♂ with mutilated anus; it belongs to the Plectiscides, near *Helictes*, and not to the Mesoleptini, as stated by Cameron.

HYMENOPHARSALIA, Morl. Revis. Ichn., Feb. 1913, p. 97= *Parophionellus*, Brues, Bull. Amer. Mus., Oct. 1913, p. 495= *Pharsalia*, Cress. Trans. Amer. Ent. Soc. 1872, p. 177 (nec Thoms. 1864; *cf.* Schulz, Zool. Ann. iv. p. 22).

XLIII.—*On some of the External Characters of the Genus* Linsang, *with Notes upon the Genera* Poiana *and* Eupleres. By R. I. Pocock, F.R.S., Superintendent of the Zoological Society's Gardens.

[Plates XII. & XIII.]

In addition to a number of skins of the three described species of *Linsang*—better, but erroneously, known as *Prionodon*—there are in the British Museum a spirit-preserved example of the genotype, *L. linsang* (=*gracilis*), collected in Sumatra by H. O. Forbes, and Blanford's type of *L. maculosus* from Tenasserim. The following notes, containing particulars about certain cutaneous characters, not described, or only imperfectly described previously, are based upon this material. Of the other genera referred to in this paper, namely *Poiana, Fossa*, and *Eupleres*, only dried skins are available for examination. It has not been possible therefore to add many new facts in connection with these forms.

The Genus Linsang (=Prionodon).

The *rhinarium* (Pl. XII. fig. 5) recalls that of *Genetta*. Its upper margin, seen from the front, is mesially flattish, with obtusely rounded angles. The anterior apertures of the nares are small and widely separated; the infranarial portion is quite shallow laterally, does not extend beyond the narial slits, and its inferior border inclines obliquely upwards on each side. The groove which cleaves the upper lip passes about half-way up the anterior surface of the rhinarium, stopping short approximately between the nostrils.

The *ear* of *L. pardicolor* was figured by Hodgson (Calc. Journ. Nat. Hist. viii. pl. i. 1847); but the illustration suggests inaccuracy in several respects and cannot be relied upon.

The *ear* of *L. linsang* (Pl. XII. fig. 6), which has never been described, is peculiar in one or two respects. The anterior and posterior ridges arising from the inferior orifice of the meatus (*o.*), are developed as in Viverrine and Paradoxurine genera. On the antero-external ridge (*ae.*), there is a distinct but small lobate prominence above the tragus; but the antero-internal ridge, the post-tragus of Mivart (*ai.*), carries above a large valvular flap, directed backwards and overlapping and concealing the anterior end of the supratragus (*s.*). This recalls the somewhat similar lobe I have described in *Hemigalus* *. On the outer side of the postero-external ridge (*pe.*), there is a moderately strong crest (*c.*), forming a groove. This crest is continuous in front with the ridge of the tragus; behind it meets another crest or low flap of skin (*r.*), which is placed above it, the two forming together the roof and floor of the aforesaid groove. Nothing resembling the superior ridge, which extends backwards beneath the bursa, has been seen by me on the ear in any genus of Viverridæ, but the lower ridge is comparable to that of *Viverricula* and *Hemigalus*. The bursa (*b.*) is well developed. Its posterior flap is semicircular and arises behind the rim of the pinna, as in *Paradoxurus*, *Genetta*, &c.; the anterior flap is very deeply excavated and the rim of the ear below it is produced into a prominent backwardly projecting lobe, similar to, but better marked than, that of *Paradoxurus hermaphroditus* and *Hemigalus derbyanus*.

The *facial vibrissæ* are normally Viverrine in the number and distribution of their tufts, as Hodgson's figure of *L. pardicolor* shows.

The *feet* (Pl. XII. figs. 3, 4), in the example of *L. linsang*, are, broadly speaking, like those of *Genetta*, with certain exceptions pointed out by Mivart, namely, the absence of naked metatarsal ridges of skin on the hind foot and the deep segmentation of the plantar pads of both fore and hind limbs. In the latter particular these pads differ from those of all the genera of Viverrinæ, where the three lobes are defined merely by shallow grooves and thus constitute a continuous cushion, such as is seen in the Felidæ and Canidæ. The digital pads are small and surrounded by velvety hair, the claws are completely retractile and probably guarded basally by skin-lobes, although this feature could not be substantiated without cutting away the hair at the tips of the digits. The interdigital web extends up to the proximal ends of the digital pads and, like the underside of the digit, is clothed with short hair except close to the pad, where the skin is nearly naked and gives off short streaks along the proximal portion of the four main digits. The pollex and hallux are short, their small digital pad being set almost on a level with the posterior angle of the internal lateral lobe of the plantar pad. Attached to this posterior angle in the fore foot is a large ovate pollical lobe (*pl.*). The main portion of the carpal pad (*c.*) is large, cordate or ovate. On its inner side is a small supplementary lobe, from which a naked strip of skin extends up to the pollical lobe. The hallucal lobe (*hl.*) on the hind foot is much smaller than the pollical lobe, and is separated by a space at least equalling its own diameter from the nearest point of the plantar pad, a narrow strip of naked skin passing between the two.

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* Ann. & Mag. Nat. Hist. (8) xvi., Sept. 1915, p. 155.

The feet of the example of *L. maculosus*, from Tenasserim, differ in one or two small particulars from those described above. In the fore foot the points of contact between the lateral and median lobes of the plantar pad are a little shorter, the internal lateral lobe is longer and is separated by a deeper constriction from the smaller pollical lobe, and the carpal pad is not connected with the pollical lobe by a naked strip of skin. In the hind foot, on the other hand, the hallucal lobe is closer to the posterior angle of the internal lateral lobe of the plantar pad, and the median lobe of this pad projects nearly as far backwards as the posterior angle of the external lateral lobe.

The feet of an unnamed species, figured by Mivart (P. Z. S. 1882, p. 158), agree on the whole with those of *L. maculosus* above described; but those of *L. pardicolor*, depicted by Hodgson (Calc. Journ. Sci. viii. pl. i. 1847), are distinguished by having both the pollical and hallucal lobes quite small (no larger, indeed, than the digital lobes of those digits), and separated by a space about equalling their own diameter from the plantar pad, and this space appears to be entirely overgrown with hair. Blanford, indeed (Mamm. Brit. India, p. 102, 1888), mentions this as a feature distinguishing *L. pardicolor* from *L. maculosus*. Hodgson, however, had previously given a figure of the hind foot of *L. pardicolor* (Calc. Journ. Nat. Hist. ii. pl. i. 1842); and this differs from the later illustration, taken from a different specimen, not only in the shape of the plantar pad, but in the greater proximity of the hallucal lobe to the nearest point of the plantar pad. These differences may be due to errors in drawing or to individual variation; but until this has been ascertained by further observations upon the feet in specimens freshly killed or preserved in alcohol, I think it would be unwise to make use of the recorded differences in the pads in discriminating the species of this genus, especially as dried skins from Sikkim and Burma in the British Museum do not bear out the view that the pollical and hallucal lobes are separated by hairy tracts from the plantar pads. Nevertheless, on morphological grounds, the upward migration of the hallucal element of the plantar pad, which, at all events, has taken place in *L. linsang*, whatever may be the case in *L. pardicolor*, only occurs in one other genus of the Viverridæ —namely *Fossa*, from Madagascar.

The Perineal Region.—In the characters considered hitherto, there is nothing in the structure of *Linsang* warranting its separation from the group containing *Genetta*, *Civettictis*, *Viverra*, and *Viverricula*, with which it is by common consent associated. That is to say, *Linsang* does not differ from those genera more than they differ from each other, except in the character of the ear.

But there is one character, in my opinion important and fundamental, which enforces the exclusion of *Linsang* from that category—namely, the absence of the scent-pouch. The evidence for this, which is, I think, conclusive, may be briefly given. Of *L. pardicolor*, Hodgson wrote, "like the cats, *Prionodon* is void of either anal* or pubic glands or pores, so that the living animals are perfectly free from all offensive odour or peculiar scent" (Calc. Journ. Nat. Hist. viii. p. 42, 1847). This statement, so far as the scent-gland is concerned, was confirmed by Mivart on a specimen which I judge by its feet belonged to *L. maculosus* (P. Z. S. 1882, p. 158). He wrote:—"Not only was there no opening between the penis and testes, but no glandular stricture in that situation beneath the skin could be detected either by me or by Mr. William Pearson, who assisted me in the dissection." Finally, Blanford, who had in 1878 a specimen of *L. maculosus* preserved in alcohol (Journ. As. Soc. Bengal, xlvii. pt. 2, p. 152, 1878), said ten years later, "No presciotal glands."

In the female example of *L. linsang*, from Sumatra, in the British Museum, the vulva is close to the anus, being separated therefrom by a narrow strip of hairy skin exhibiting no trace whatever of glandular lobes or pouch (Pl. XII. fig. 7). There are thus two particulars in which this region differs from that of the Viverrinæ, the absence of the gland and the proximity of the vulva to the anus, both being characters in which *Linsang* resembles the Felidæ and differs from the Viverrinæ. Mivart unfortunately failed to note the position of the prepuce with regard to the scrotum in the male he examined. I suspect, however, that resemblance will be found between the Felidæ and *Linsang* in this respect also.

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* The anal glands, as a matter of fact, are present. Possibly Hodgson was referring to the glandular anal pouch he was probably familiar with in mongooses.

In view of the constancy of the occurrence and the high degree of development of the scent-glands in the Viverrinæ, it seems to me to be impossible to maintain that *Linsang* is nearly related to any genus of that group. Nor does it seem to me to be reasonable to suppose that the ancestors of *Linsang* possessed the gland. A specialised organ of that kind would not, it may be supposed, abort without some radical change in mode of life, depriving it of its usefulness. But, so far as can be judged from their teeth, feet, pattern, and other external features, the Linsangs do not differ in habits from *Genetta* or *Viverra* *.

The Genus Poiana.

On structural grounds, cranial, dental, pedal, etc., the genus *Poiana*, restricted to the tropical forest-region of Africa, is always, and unavoidably from available data, associated with *Linsang*. I am not aware, however, that there is any direct evidence that *Poiana* is without the scent-glands; and there are no alcohol-preserved examples whereon this character may be observed. The inference as to their absence is provisionally justified; but the uncertainty of its truth must be borne in mind. If *Poiana* prove to possess this organ, the genus will, according to my views, take a place in the Viverrinæ with *Genetta*, *Viverra*, and the others. For the time being, however, it may be kept with *Linsang*.

The feet of *Poiana* (Pl. XII. figs. 1, 2), judging from dried skins, differ from those of *Linsang* in one or two particulars which recall the feet of *Genetta*. In the fore foot the carpal lobe (*c.*) is very manifestly double. Its external moiety is large, long, and fusiform; its internal moiety is much smaller, but quite well defined, and is wedged in between the external moiety and the elongated pollical lobe (*pl.*) of the plantar pad, which anteriorly touches the posterior angle of the internal lateral lobe of the plantar pad. In most of the dried skins the area between the plantar and carpal pads is naked, but in some it is partially hairy, suggesting that the nakedness is due to post-mortem "slipping" of the hair. This is, I think, the probable, but not the certain, explanation.

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* In my paper upon *Cynogale* (Ann. & Mag. Nat. Hist. (8) xv. p. 359, 1915), I have suggested the possibility of the simple structure of the scent-gland in that genus being attributable to the adoption of an amphibious life and to the modifications in habits thereby enforced.

In the hind foot the hallucal lobe (*hl.*) is very large, as large as the internal lateral lobe of the plantar pad, with the posterior angle of which it is in contact. A little way above this and separated from it by a hairy tract is a small, narrow, bilobed, metatarsal pad like that of *Civettictis* and representing the area of the double metatarsal streak, where it bifurcates inferiorly, in *Genetta*. Above this little metatarsal pad in *Poiana* there is a narrow streak of naked integument which extends about as far along the underside of the metatarsus as the manifestly double ridge in *Genetta*.

The digital pads in both fore and hind feet are small and surrounded by velvety hairs; the claws are completely retractile and are probably guarded basally by skin-lobes.

The Genus Fossa.

Disregarding the absence of the scent-pouch, Mivart classified *Linsang* and *Poiana* with *Viverra*, *Viverricula*, and *Genetta*. He also placed in that category the Mascarene genus *Fossa*, which also has no scent-pouch, comparing it more particularly, but for no very obvious reason, with *Viverricula*. Although unable to give a diagnosis of any value of this group, he yet spoke of it as an assemblage of closely allied forms, a claim which, in my opinion, cannot be maintained.

Of the genus *Fossa* I have seen only three dried skins of adult animals—namely, two of *F. fossa* and one of *F. majori*, all in the British Museum. I can find no trace of the gland in these. In the best-preserved example (Pl. XIII. fig. 4) the area between the anus and the prepuce is continuously hairy, and special attention must be drawn to the position of the prepuce far in advance of the scrotal area, as in *Cryptoprocta*, which also has no such pouch. I believe the first-recorded evidence as to the absence of these glands in *Fossa* is the statement of M. Poivre, quoted by Mivart, that he discovered no scent-pouch and observed no perfume in a freshly killed example *.

In *Fossa* the *legs* (Pl. XIII. figs. 5, 6) are slender and elongate, the paws are much less furry than in *Poiana* and *Linsang*, and the digital pads are larger. If the term "feline" be applied to the feet of the African and Asiatic genera, "canine" would better express the character of those of *Fossa*. The claws appear to be very imperfectly, if at all, retractile, and the space between the plantar and digital pads is naked or bears three patches of hair. The plantar pad is trilobed, subsymmetrical, and smooth and the lateral lobes of the pad project some distance behind the median lobe. Attached to the posterior angle of the internal lateral lobe of the fore foot is a small pollical lobe (*pl.*), close to which lies the digital pad of the pollex, the pollex itself being short and separated by a comparatively long interval from the digital pad of the second digit. There is a single, undivided, conical, carpal pad some distance above the plantar pad, the intervening space being entirely covered with hair, completely isolating the carpal pad (*c.*).

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* M. Poivre also said, however, that the natives of Madagascar assured him that the male "fossane," when "on heat," has a strong odour of musk. I strongly suspect that this apparent contradiction is due to confusion between two animals, and that the Malagasy natives were referring, not to *Fossa*, but to *Viverricula*, which also occurs, but doubtless by importation, in Madagascar.

In the hind feet the short hallux is set higher above the plantar pad than in any genus of Viverridæ, not excepting *Viverricula*, and the very small hallucal lobe (*pl.*) of the plantar pad is withdrawn from that pad in company with the hallux and simulates a second digital pad for that digit. The metatarsus is entirely covered with hair, except for a very small submedian pad (*mt.*) lying nearly midway between the plantar pad and the heel.

Judging from the limbs, *Fossa* is the most digitigrade of the Viverridæ, and appears to be adapted for swift running rather than for climbing; but it does not appear to me that the differences between its feet and those of *Linsang* and *Poiana* are greater or of higher systematic value than those between the feet of the Viverrine genera *Civettictis* and *Genetta*, the former being a terrestrial and the latter an actively scansorial animal. On the other hand, it must be remembered that *Fossa* and some of the species of *Linsang* are the only representatives of the Viverridæ in which the hallucal element of the plantar pad is separated by a hairy tract from that pad.

Provisionally, therefore, but quite provisionally pending the examination of fresh material, *Fossa* may be classified with *Linsang* and *Poiana*, despite its more generalized dentition, attested by the presence of two well-developed upper molars behind the carnassial, *pm*^{4}, which is situated well in advance of the posterior root of the maxillary portion of the zygomatic arch—broadly speaking, a Paradoxurine as opposed to a Viverrine character. In *Linsang* and *Poiana*, on the contrary, there is only one small upper molar behind the carnassial, which is set close to the posterior root of the maxillary portion of the zygomatic arch, as in the Viverrinæ.

The pattern of *Fossa* may be briefly referred to. In the typical species, *F. fossa*, it consists of spots on the body and bands on the neck; but in *F. majori*, Dollm., there are four longitudinal dark stripes on each side. The uppermost of these runs from just behind the occiput to the root of the tail, the spinal area being without a median stripe. The second follows a parallel course, but extends farther forwards to the root of the ear, and becomes more broken up on the thigh. The third is shorter and only reaches the base of the neck. The fourth and lowest is quite short and thinner. It extends from the outside of the thigh about halfway along the line where the flank passes into the belly. The general resemblance of this pattern to that of *Galidictis** is obvious, despite the great differences between the two genera.

A newly born young, probably belonging to *F. majori*, but referred by Mivart to *F. fossa*, resembles the adult of the former species, except that there is a pair of very narrow parallel stripes in the lumbar region. These, I suspect, represent the median spinal stripe seen in *Genetta*. If so, they suggest that this stripe has been suppressed in *Fossa* as in *Galidictis*.

The Genus Eupleres.

One other genus may be briefly considered in this connection, namely *Eupleres*, a Mascarene form so aberrant in dentition that Mivart made it the representative of a special subfamily, Euplerinæ, a view with which I am not prepared to disagree. Of this animal I have only seen one stuffed example in the British Museum, but according to Miss Carlsson (Zool. Jahrb. Syst. xvi. pp. 218–236, 1902) the genus is more Viverrine than Mungotine (Herpestine). To this author's list of characters affiliating *Eupleres* with the Viverrines may be added the presence of the bursa on the ear. As she has shown, there is no perineal scent-pouch, no anal sack, the vulva is tolerably close to the anus (Pl. XIII. fig. 1), the hind foot is covered with hair down to the plantar pad, in the fore foot the area between the carpal pads and the plantar pad is hairy, the paws are broad and short, the digital pads are wide and not compressed, and the web joining the toes extends to their proximal ends (Pl. XIII. figs. 2, 3). In all these respects *Eupleres* resembles *Linsang* and *Fossa*. The claws are longish and not retractile, or only imperfectly so, as in *Fossa*; and, as in some examples, at all events, of the latter, the area between the digital and plantar pads is quite naked. The plantar pads are large and normally trilobate, and the internal lateral lobe has a moderately large pollical (*pl.*) or hallucal lobe (*hl.*) attached to its posterior angle. There is no metatarsal pad, but a strip of naked skin runs obliquely inwards and upwards to the middle line from the angle of the external lateral lobe of the plantar pad. The carpal pad (*c.*) is double and closer than usual to the plantar pad, its subspherical external or ulnar moiety being larger than the internal; between the former and the external lateral lobe of the plantar pad there is a small area of naked skin.

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* See Ann. & Mag. Nat. Hist. (8) xvi. pl. vii. (1915).

In the characters so far enumerated there is nothing to distinguish the feet of *Eupleres*, otherwise than generically, from those of the genera previously discussed in this paper, or, indeed, from those described in my paper upon the Viverrinæ (P. Z. S. 1915, pp. 131-149); but in one character they are peculiar, namely, the comparatively large size and low position of the hallux and pollex—a primitive feature, suggesting that, although truly digitigrade, *Eupleres*, when standing, has the five digital pads instead of four in contact with the ground.

Conclusion.

Assuming provisionally the absence of perineal scent-glands in *Poiana*, the four genera discussed in this paper differ by that negative character from those I have recently dealt with elsewhere, which may be referred to the four subfamilies of Viverridæ, namely, the Viverrinæ (*Viverricula*, *Viverra*, *Civettictis*, *Genetta*), the Hemigalinæ (*Hemigalus*, *Chrotogale*, *Diplogale*), the Cynogalinæ (*Cynogale*), and the Paradoxurinæ (*Paradoxurus*, *Paguma*, *Macrogalidia*[*], *Arctictis*, *Arctogalidia*, *Nandinia*). I do not think it is placing a too high value upon the characters distinguishing these groups to assign them the rank of subfamilies. The Paradoxurinæ, indeed, may be susceptible of finer subdivision, *Nandinia* especially having strong claims to be regarded as the representative of a special group of that standing. However that may be, the fourteen genera so classified agree, so far as is known[†], with each other in possessing the scent-gland in diverse forms and positions in both sexes[‡]; and this is a very special organ probably inherited from a common ancestor, and presumably not likely to be lost when once acquired and elaborated.

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[*] Proposed by Schwarz (Ann. & Mag. Nat. Hist. (8) v. p. 423, 1910) for *Paguma mussenbroeki* from Celebes.

[†] Not verified in *Chrotogale* and *Diplogale*.

[‡] Not verified in the male of *Arctogalidia*.

The three genera *Linsang*, *Poiana*, and *Fossa*, which are without the scent-gland, I propose to allocate to the subfamily Linsanginæ, with the proviso that *Fossa*, when better known, may have to be eliminated therefrom, and placed by itself in a subfamily, the Fossinæ.

The Linsanginæ and the Euplerinæ may be characterized as follows:—

Viverrids with no scent-pouch and the vulva tolerably close to the anus; feet digitigrade and hairy down to the plantar pads, the metatarsal pads being reduced or absent and the carpal pads or pad much smaller and narrower than the plantar pad.

- *a.* Hallux and pollex with large digital pads and close to the second digit; jaws long and slender, teeth reduced in size, the canines exceedingly small and the premolars widely spaced .... *Euplerinæ* (*Eupleres*).
- *a'.* Hallux and pollex very short, with small digital pads and set well above the second digit; skull and teeth unmodified ...... *Linsanginæ*.
  - *b.* Feet with large digital pads, not imbedded in velvety hair; claws at most partially retractile, unguarded by lobes of skin; area between plantar and digital pads naked or mostly so; hallux high above plantar pad, with accessory pad close to it .... *Fossa*.
  - *b'.* Feet with small digital pads imbedded in velvety fur; claws completely retractile and probably guarded by skin-lobes; area between plantar and digital pads thickly hairy; hallux scarcely higher up than plantar pad, its accessory pad (hallucal lobe) close to or touching the plantar pad.
    - *c.* No metatarsal pads; hallucal lobe of plantar pad small .... *Linsang*.
    - *c'.* A long, narrow, median metatarsal pad, ending inferiorly in a bilobed enlargement; hallucal lobe of plantar pad very large .... *Poiana*.

EXPLANATION OF THE PLATES.

Plate XII.

Fig. 1. Left fore paw of *Poiana richardsoni* (from dried skin) from the Benito River (digits not separated). *pl.*, pollical lobe of plantar pad; *e.*, external lobe of carpal pad.

Fig. 2. Left hind foot of same. *hl.*, hallucal lobe; *mt.*, metatarsal pad.

Fig. 3. Right fore paw of female *Linsang linsang* from Sumatra (digits partially separated). *pl.*, pollical lobe; *c.*, external lobe of carpal pad.

Fig. 4. Right hind foot of the same. *hl.*, hallucal lobe.

Fig. 5. Rhinarium of the same.

Fig. 6. Base of ear of the same. *s.*, supratragus; *b.*, bursa; *pe.*, postero-external ridge; *e.*, crest on outside of latter; *r.*, supplementary ridge; *o.*, inferior orifice of meatus; *ae.* and *ai.*, antero-external and antero-internal ridges.

Fig. 7. Ano-genital area of the same. *a.*, anus; *v.*, vulva.

PLATE XIII.

Fig. 1. Anal and genital area of female *Eupleres goudoti* (after Carlsson). *v.*, vulva; *a.*, anus.

Fig. 2. Right hind foot of the same. *1* and *5*, first and fifth digits; *hl.*, hallucal lobe attached to plantar pad.

Fig. 3. Right fore foot of the same. *1* and *5*, first and fifth digits; *c.*, double carpal pad, with spot of naked integument between the larger or outer lobe and the plantar pad; *pl.*, pollical lobe of pad.

Fig. 4. Anal and genital area of male *Fossa fossa* (dried skin). *a.*, anus; *sc.*, scrotum; *p.*, prepuce.

Fig. 5. Left fore foot of *Fossa majori* (dried skin). Lettering as in fig. 3.

Fig. 6. Left hind foot of the same. Lettering as in fig. 2, with addition of *mt.*, metatarsal pad.

XLIV.—*On some External Characters of* Galidia, Galidictis, *and related Genera.* By R. I. POCOCK, F.R.S., Superintendent of the Zoological Society's Gardens.

[Plates XIV. & XV.]

THE indigenous Mascarene carnivores *Cryptoprocta*, *Fossa*, *Galidia*, *Salanoia* (*Hemigalidia*), *Galidictis*, and *Eupleres* were referred by Mivart to the Viverridæ under the subfamilies Cryptoproctinæ (*Cryptoprocta*), Viverrinæ (*Fossa*), Galidictinæ (*Galidia*, *Galidictis*, and *Salanoia*), and Euplerinæ (*Eupleres*). Although his definitions were not altogether convincing, the groups themselves will no doubt be admitted by modern systematists, possibly with elevation to the higher rank of families. With *Cryptoprocta* I am not now concerned; *Fossa* and *Eupleres* I suggest (see the preceding paper) may be regarded respectively as divergent types of a primitive group of Viverrids, antedating the ancestor of the groups now characterised by the possession of the scent-gland. With *Fossa* I associate *Linsang*, for the reason that it also is without that organ; and *Poiana* inferentially, and therefore provisionally, goes with *Linsang*, pending the examination of fresh material to establish, or disprove, its possession of the gland.

The confidence I place in this gland, as an important criterion of affinity and as a basis for the classification of the Viverridæ, is admittedly founded on two assumptions: first, that a specialised organ of that description when once acquired and elaborated is not likely to be eliminated, without some radical change in mode of life depriving it of its usefulness; and, second, that there is nothing to justify the view that it has been acquired twice, or more times, within the limits of this group of Æluroid carnivores.

I therefore attach to it a systematic value higher than that accorded to the feet or teeth which, there is evidence to show, are organs of a high degree of plasticity along certain lines, the teeth altering in size, shape, and position apparently in accordance with diet, and the feet becoming modified in the direction of digitigradism and other particulars according to the mode of progression required by the nature of the soil, the change from terrestrial to scansorial habits, or *vice versa*.

The Scent-gland.—Adopting the scent-gland as a criterion, the systematic position of the three remaining Mascarene genera, *Galidia*, *Salanoia*, and *Galidictis*, and the recently established *Mungotictis* (Ann. & Mag. Nat. Hist. (8) xvi. p. 120, 1915), remains to be settled. In some characters they resemble the mongooses, in some the civets and genets, in some they differ from both those sections. They are not definitely classifiable with either. But I think it is a mistake to consider them as intermediate between the two, or as inclining rather to the mongooses than to the civets, as Mivart held. Since Mivart's time fresh or spirit-preserved examples of *Galidictis* and *Galidia* have been examined, and the scent-pouch has been found in both.

A female example of *Galidictis eximius* (=*striata*) was examined by Beddard, and his figure of the gland (Pl. XIV. fig. 4) shows that in position and, apparently, in structure it resembles the homologous organ in *Genetta*, that is to say, it is wholly perineal and consists of two closely applied lobes meeting to form a narrow branching rima (P. Z. S. 1907, p. 805).

As regards *Galidia elegans*, the only known species of the genus, Beddard stated that the male has no scent-gland (P. Z. S. 1909, p. 477); but a year later Miss Carlsson detected the organ in a female of that species (Zool. Jahrb. Syst. xxviii. p. 559, 1910). This discrepancy is difficult to explain. Two explanations suggest themselves:—first, that Beddard overlooked the organ, which is improbable, unless possibly it was as little developed as it is in the young male of *Cynogale bennettii* I have recently described (Ann. & Mag. Nat. Hist. (8) xv. p. 358, pl. xiv. fig. 8, 1915); and, second, that the organ is present only in the female. This must be admitted as quite possible, despite the better development of the gland in the males than in the females of the Viverrinæ and Paradoxurinæ. If this prove to be so the fact will be one of very great interest, for, taken in conjunction with certain archaic characters of *Galidia* and *Galidictis*, it suggests that this organ may originally have been a sexual character acquired first by the female to help the male find her and, subsequently, by the male for the opposite purpose. However that may be, the present state of our knowledge only justifies the statement that the gland is present in the females of the two genera under discussion.

It may be added that Miss Carlsson's figure of the gland in the female *Galidia elegans* (Pl. XIV. fig. 3) shows that it is a perineal pocket, the labia of which pass forwards in front of the vulva and clitoris, foreshadowing the condition seen in *Paradoxurus* and *Paguma*, as I have recently pointed out (P. Z. S. 1915, pp. 401–405); but, as in the Viverrines, the walls of the space are covered with short hair. It is also interesting to note that an examination of dried skins of *Galidia* and *Galidictis* shows that the prepuce is situated far in advance of the scrotum, as in *Fossa* and *Cryptoprocta*, and that this character alone serves to separate the genera concerned from the mongooses. The absence of the anal pouch and the structure of the ear, which has a well-developed marginal bursa and a long and strong tragus-bearing crest, further distinguish *Galidia* and *Galidictis* from the mongooses.

Nothing is known apparently about the presence or absence of scent-glands in *Mungotictis* and *Salanoia*. The provisional inference as to their presence—at all events, in the female—is justified by the many likenesses and few unlikenesses between those genera and *Galidia* and *Galidictis*.

The Vibrissæ, Rhinarium, and Ear.—The tufts of facial vibrissæ are normal in number and situation, consisting of mystacial, supraocular, and two genal on each side and of an interramal in the middle line of the throat. The individual vibrissæ are mostly long.

The rhinarium, judging from dried skins, is small, as in the genets and mongooses. The upper lip is cleft and the groove marking it extends at least up to the summit of the anterior surface. The infranarial portion is deep, but not laterally extended as a broad band beneath the slit of the nostril. Seen from above, the anterior edge of the upper surface is medianly notched and apparently lightly biconvex in *Galidictis* and *Galidia*, but without a notch and straight or lightly convex from side to side in *Mungotictis*.

The pinna of the ear (Pl. XV. fig. 4) is larger than in most mongooses, except *Cynictis*, but smaller on the average than that of the Viverrines and Paradoxurines. It has a well-developed bursa (*b.*), of which the anterior and posterior flaps arise together from the margin of the pinna above, giving this margin the appearance of bifurcation. The edge of the anterior flap is not notched or markedly concave. The two anterior basal ridges (*ae.*, *ai.*) are well developed, the external or tragus-bearing ridge extending upwards nearly to the anterior base of the supratragus or *plica principalis* (*s.*), and the internal sweeps across beneath the supratragus somewhat as in the mongooses, without sloping so obliquely downwards as in the Viverrines and Paradoxurines; but the supratragus has no thickening. The ridge of the antitragus (*pe.*) rises from the inferior orifice of the meatus, but there is no apparent groove or ridge on its outer surface. The possession of a well-developed bursa distinguishes the ear of the Galidictinæ from that of the mongooses, and in none of the latter is the tragus-bearing antero-external ridge so well developed. Nevertheless, in the simpler structure of the ridges, the higher position and lesser downward inclination of the antero-internal ridge, and the absence of lobate thickening on the antitragus, the ear recalls that of the mongooses.

The Feet.—So far as I am aware, the feet of *Galidictis* have never been examined on fresh material and never figured. Those of *Galidia*, as figured by Miss Carlsson, show some interesting points, which I have verified as far as possible on available skins. The fore foot (Pl. XIV. fig. 2) is naked beneath from the toes back to and including the region of the carpal pads. The digits are webbed up to the proximal end of the digital pads, and the edges of the web are not deeply emarginate. The claws are of moderate length, not retractile, unguarded by skin lobes, and unprotected basally by thick-growing hair. The pollex, although rather short, is not set high up, but projects nearly in a line with the middle of the plantar pad, which is typically trilobed and has a large pollical lobe barely in contact with its internal lateral lobe. The elements of two carpal pads are present, and these, taken together, seem to be at least equal to the plantar pad in area. The outer, on the ulnar side, is very large and is defined from the inner, which is in contact throughout its width with the pollical element of the plantar pad, by a deep notch jutting backwards from the rather short, naked, depressed area between the carpal and the plantar pads.

The hind foot (Pl. XIV. fig. 1) is naked back to the heel. The digits and plantar pad resemble in a general way those of the fore foot. Two metatarsal pads are retained. The inner, the thicker of the two, is separated from the hallucal lobe of the plantar pad. The outer, which is thinner and subfusiform, is set lower down. Its proximal end is in contact, or nearly so, with the middle of the admedian edge of the inner lobe; its distal end runs downwards and ceases before reaching the plantar pad, the interval between the two being a little less than that which separates the inner metatarsal pad from the hallucal lobe of the plantar pad.

None of the examples of *Galidia* which I have seen bear out Mivart's statement (P. Z. S. 1882, p. 188) that "the tarsus and metatarsus are covered beneath with sparse short hairs, or are more or less inclined to be bald." The feet appear to me to be quite naked beneath.

From an examination of dried skins it appears that the feet of *Galidictis* differ in the main from those of *Galidia* in having the digits longer, less fully webbed, and provided with longer claws, those of the fore feet being especially elongated. In these respects they recall the feet of the true mongooses, but, as is also the case in *Galidia*, the pollex and hallux are lower down than in those animals, thus attesting a more primitive type of foot. The fore foot, moreover, is more markedly asymmetrical than in *Galidia*, the third digit being considerably longer than the fourth and the fifth being set far back so as to be only a little in advance of the pollex and considerably behind the second digit. The foot, in fact, approaches the "perissodactyl" type more closely than in any living carnivore I have seen, in the sense that the long third digit lies nearly in the middle line and is flanked by the second and fourth, which are not very unequal in length, with the first and the fifth much shorter and higher up. This arrangement is not noticeable on the hind foot (Pl. XV. fig. 3), which is artiodactyl, the middle line passing between the third and fourth, which are subequal, the second on the inner side of the foot balancing the fifth on the outer side.

The feet of *Mungotictis* are similar to those of *Galidictis*, except that the heel is naked and not hairy (Pl. XV. figs. 1, 2).

The Pattern.—Apart from the annulation of the tail in *Galidia*, this genus and *Salanoia* show no trace of pattern. *Galidictis* and *Mungotictis*, on the other hand, have a definite pattern of longitudinal stripes on the body, and *Galidictis*, in addition, shows spots or stripes on the base of the tail.

It would be rash to claim that the pattern in either of these genera is the primitive carnivore pattern; but, since there is a good deal of convergent evidence that the primitive pattern of this order consisted of longitudinal lines, it is interesting to find this type present in Mascarene genera, intermediate in some respects between such widely divergent groups as the genets and mongooses. Analysis of the pattern of the genets, as a whole, shows that on the body it is resolvable into five longitudinal bands of spots on each side and a median uninterrupted stripe down the back. Over the shoulders and the nape of the neck the continuity of these stripes is generally interrupted to a greater or less extent, and their course is not always easy to follow; but the extension of the three dorsal stripes on each side over the shoulders and up to the occiput in *Mungotictis vittatus* (see Ann. & Mag. Nat. Hist. (8) xvi. pl. vii. fig. 3), suggests that the pattern on the neck of genets is derived from the breaking up of at least six stripes with the addition of the median stripe. Although in some examples of Galidictinæ the median spinal stripe does not exist, nevertheless, it can be detected as a narrow band on the fore part of the neck of *Galidictis eximius* and on part of the dorso-lumbar area in *Mungotictis vittatus*.

The resemblance in pattern between *Galidictis* and *Mungotictis*, on the one hand, and the Genets, on the other, strengthens the claim of relationship between the Galidictinæ and the Viverrinæ based upon the structure and relations of the perfume-gland.

EXPLANATION OF THE PLATES.

Plate XIV.

Fig. 1. Right hind foot of *Galidia elegans*, drawn from dried skins.
Fig. 2. Right fore foot of the same.
Fig. 3. Anal and genital area of *Galidia elegans* (after Carlsson). *a.*, anus; *gl.*, glandular pouch, with labia distended; *v.*, vulva.
Fig. 4. Anal and genital area of *Galidictis eximius*; lettering as in fig. 3, the labia of gland in contact.

Plate XV.

Fig. 1. Left hind foot of *Mungotictis substriatus*, drawn from dried skin.
Fig. 2. Left fore foot of the same.
Fig. 3. Left hind foot of *Galidictis eximius*.
Fig. 4. Right ear of *Galidictis eximius* (from dried skin). *b.*, *bursa*; *s.*, supratragus; *pe.*, postero-external or antitragal ridge; *ae.*, antero-external or tragal ridge; *ai.*, antero-internal ridge.

XLV.—*On the African Shrews belonging to the Genus* Crocidura.—V. By Guy Dollman.

[Continued from p. 146.]

Group 11 (*nigricans*).

Size medium. Colour above greyish or dark blackish brown. Second upper unicuspids rather broader than third.

(64) *Crocidura boydi*, sp. n.

Allied to *arethusa* and *nigricans*, but distinguished by its skull, which has a much shorter and blunter muzzle and considerably shorter tooth-row.

Size rather smaller, hind foot only 11 mm. in length.

Colour of upper parts greyish brown ("mouse-grey" mixed with "mummy-brown"), the grey hair-bases rather less conspicuous. Underparts whitish, strongly contrasting with the brownish grey of the flanks. Backs of hands and feet whitish. Tail short, rather coarsely haired, brown above, dirty buff below; bristle-hairs numerous, evenly distributed throughout the entire length of the tail, white in colour.

Skull with very short broad muzzle, much shorter than in *arethusa*. Small upper unicuspids crushed together, the second appearing a trifle broader than the third and its cusp longer.

Dimensions of the type (measured in the flesh):—

Head and body 80 mm. (stretched); tail 38; hind foot 11; ear 6.

Skull (brain-case broken): least interorbital breadth 4·5; length of palate 8·6; greatest maxillary breadth 7·8; length of upper tooth-row 9.

Hab. Titebbi, Welle River.

Type. Adult female. B.M. no. 7. 7. 8. 52. Original number 103. Collected on June 19th, 1906, by the late Captain Boyd Alexander during the Alexander-Gosling Expedition.

The smaller hind feet, shorter tail, and much shorter muzzle and tooth-row distinguish this Welle River species from the Nigerian *arethusa*. The unicuspids are more as in *nigricans*, the second being rather larger than the third; on this account it has been thought best to place this Welle River species between the *arethusa* group and *nigricans*.

(65) *Crocidura nigricans*, Boc.

Crocidura nigricans, Bocage, Jorn. Sc. Lisb. i. p. 29 (1889).

Probably allied to the Welle River species described above and to *nigrofusca* from the Semliki District.

The colour is as follows:—"Pelage en dessus d'un noir-bleu d'ardoise uniforme, en dessous plus pâle; les poils d'un cendré de plomb à la base; .... la queue noirâtre en dessus, brunâtre en dessous."

The second upper unicuspid ("i^3") is stated to be larger than the third or canine, which is a little longer than the anterior cusp of the large premolar.

Dimensions of the type (as given by Bocage):—

Head and body 70 mm.; tail 52; hind foot 12.

Hab. Quindumbo, Angola.

Type. In Lisbon Museum.

In general dental characters this species would appear to agree with *nigrofusca* and to a certain extent with the preceding species; but the general dimensions and colour are very different, *nigrofusca* being considerably browner and having a larger hind foot and longer tail, while the Welle River species is considerably paler in colour and with a much shorter tail.

(66) *Crocidura nigrofusca*, Matsch.

Crocidura nigrofusca, Matschie, Säug. Deutsch. Ost-Africa, p. 33 (1895).

About equal in size to *turba*, but with a much longer tail and having the second upper unicuspids larger than the third.

Colour above dark blackish brown, the new pelage near "blackish brown (1)" mixed with "mummy-brown," and the worn coat about as in "mummy-brown." Flanks a trifle paler, the tint merging gradually into the dull brownish grey of the belly. Backs of hands and feet dark brown. Tail long, dark brown above and below; bristle-hairs confined to basal half, not very conspicuous.

Skull much as in *turba*, but with the second upper unicuspid larger than the third. There seems to be some error in Matschie's description of the unicuspids, probably due to a different understanding of the dental nomenclature; he writes, "i_3 und pm_4 im Oberkiefer sind ungefähr gleich breit, aber i_3 ist fast doppelt so gross wie c und der vordere Hocker von pm_4 ist wenig kleiner als c." I have accepted three specimens from the Upper Congo as representing

Matschie's species; they agree with the description very closely as regards general dimensions and colour, and have the second upper unicuspid rather larger than the third, but otherwise the teeth are quite normal.

Dimensions of the type (as given by Matschie) :—

Head and body 65 mm. ; tail 68 ; hind foot 16 ; ear 9·9.

Dimensions of three specimens from the Upper Congo (measured in the flesh) :—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂	78	67	15	10·5
♂	74	65	15	10
♀	77	63	15	10·5

Hab. Wukalala Camp, Kinyawanga, west of Semliki.

Type. In Berlin Museum.

This species is distinguished from the allied forms by its dark blackish-brown colour and long dark-coloured tail.

Group 12 (*luna*).

Size medium. Colour above pale or slaty grey washed with cinnamon or brownish. Skull with anterior corners square-shaped. Second and third upper unicuspids about equal in size.

(67) *Crocidura luna*, Dollm.

Crocidura luna, Dollman, Ann. & Mag. Nat. Hist. (8) vol. v. p. 175 (1910).

Size about as in *turba*, but pale smoke-grey in colour and with a squarer brain-case.

Size of body and hind foot about as in *turba*, tail longer.

General colour of upper parts pale smoke-grey ("deep mouse-grey," finely speckled with "snuff-brown"), rather browner on the back and paler on the flanks, strikingly different from the dark sepia-coloured pelage of *turba*. Underparts slaty grey washed with silvery white; hairs of belly with slate-grey bases and white tips. Backs of hands and feet thinly covered with greyish-white hairs. Tail fairly long, general appearance much less hairy than in *turba*, greyish white above and below; caudal bristle-hairs fairly numerous.

Skull longer than in *fumosa*, as strongly built as in *turba*; anterior angles of brain-case sharply pointed, not rounded, giving the cranial region a square appearance; in size the brain-case is about as in *hindei*, rather flat, considerably more so than in *turba*. Teeth intermediate between those of the *fumosa* and *turba* groups, the second upper unicuspid rather smaller than the third, not so markedly as in *fumosa*, but rather more so than in *turba*. Last molar as large as in *fumosa*. In general form this skull is like that of *monax* and the allied species *ultima*, the square-shaped brain-case being common to both groups, although not present in all the species of the *dolichura* group.

Dimensions of the type and two topotypes (measured in the flesh):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂ (type)	88	60	15	12
♂	86	57	15·5	10
♀	77	55	14	11·5

Skull-dimensions:—

	♂. Type. mm.	♂. Katanga. mm.	♀. Katanga. mm.	♀. S. Rhodesia. mm.
Condylo-incisive length ..	24·3	23·8	23·8	23·5
Greatest breadth	10·5	10·7	10·6	10·5
Least interorbital breadth ..	5·2	5·2	5·2	5
Length of palate	10·4	10	10·2	9·7
Postpalatal length	10·7	10·6	10·5	10·3
Greatest maxillary breadth .	7·5	7·7	7·7	7·3
Median depth of brain-case .	6	6	6	5·9
Length of upper tooth-row .	11	10·8	11	10·8

Hab. Bunkeya River, Katanga, S. Congo. Altitude 3400 feet.

Type. Adult male. B.M. no. 9. 1. 3. 3.

In addition to the specimens mentioned above, there are in the Collection two more from the Melsetter District, S.W. Rhodesia, which agree very closely with the type in general colour and cranial characters.

(68) *Crocidura luna umbrosa*, subsp. n.

A brown-coloured race of *luna*.

Size about as in the Katanga species.

General colour very much darker and browner, more as in the *fumosa* group, but greyer; colour of back about as in "deep mouse-grey" washed with "mummy-brown"; the grey tint of *luna* here restricted to the grey speckling. Underparts rather darker, slate-grey, hair-tips tinged with buff, not silvery. Backs of hands and feet brownish, considerably darker than in *luna*. Tail very much darker in colour, dark blackish brown above, a shade paler below.

Skull like that of *luna*, with square-shaped, sharp-angled brain-case, but rather narrower, both across cranial and maxillary regions. Teeth smaller.

Dimensions of the type (taken from dry skin) :—

Head and body 88 mm.; tail 50; hind foot 14.

Skull-dimensions of type and two paratypes :—

	♀. Type. mm.	♂. Paratype mm.	♀. Paratype. mm.
Condylo-incisive length	23·5	23	22·8
Greatest breadth	10·3	10	10
Least interorbital breadth	4·8	4·8	4·9
Length of palate	9·9	9·7	9·5
Postpalatal length	10·8	10·2	10·2
Greatest maxillary breadth	7·3	7	7·2
Median depth of brain-case ...	5·6	5·6	5·6
Length of upper tooth-row	10·5	10·5	10·3

Hab. Machakos, British East Africa. Altitude 5400 feet.

Type. Adult female. B.M. no. 1. 12. 9. 3. Original number 94. Collected and presented by Dr. S. L. Hinde.

The browner colour, darker extremities and tail, and narrower skull distinguish this Machakos race from the true *luna.*

(69) *Crocidura luna macmillani,* subsp. n.

A dark slate-grey form.

Size of body and hind foot about as in *luna,* tail rather shorter.

Colour darker throughout, upper parts dark slate washed with vandyke-brown ("deep mouse-grey," mixed with "fuscous"), flanks rather greyer, the tint gradually merging into the pure slate-coloured underparts ("deep neutral grey"), general effect considerably darker than in *luna.* Backs of hands and feet dirty white. Tail rather shorter, but as pale in colour as that of the Katanga form.

Skull considerably narrower than in *luna,* more as in *umbrosa,* but with rather smaller brain-case. General build of cranial region the same as in *luna,* anterior angles of brain-case quite as sharp, not rounded. Maxillary region rather narrow. Teeth smaller, especially the second and third upper unicuspids, third about as in *umbrosa,* second rather smaller.

Dimensions of the type (measured in the flesh) :—

Head and body 87 mm.; tail 52; hind foot 14; ear 9.

Skull: condylo-incisive length 22·9; greatest breadth 10; least interorbital breadth 4·8; length of palate 9·5; postpalatal length 10·1; greatest maxillary breadth 7·2; median depth of brain-case 5·6; length of upper tooth-row 10·2.

Hab. Kotelee, Walamo, Abyssinia.

Type. Adult female. B.M. no. 6. 11. 1. 13. Original number 148. Collected by P. Zaphiro on September 9th, 1905, and presented by W. N. McMillan, Esq.

The darker colour and narrower skull distinguish this form from the Katanga *luna*. The Machakos race cannot be confused with this Abyssinian form, the hands, feet, and tail being very much darker and the general colour browner and less slaty in *umbrosa*.

(70) *Crocidura ibeana*, sp. n.

Smaller than *luna* and more cinnamon-coloured.

Size of body and hind foot much smaller than in *luna* or the allied forms; hind foot only 12 mm. in length.

Colour of upper parts light cinnamon-brown ("pale snuff-brown" mixed with "drab," speckled with "mouse-grey"), very much as in dull specimens of *hindei*. Flanks greyer, the cinnamon tint gradually fading away and replaced on the ventral surface by light grey, much less slaty than in *luna* or *macmillani*. Backs of hands and feet dirty white. Tail fairly long, caudal bristle-hairs short and inconspicuous; colour above reddish brown, whitish below.

Skull considerably smaller than in *luna*, with much smaller teeth; anterior angles of cranium quite as square.

Dimensions of the type (measured in the flesh):—

Head and body 74; tail 47; hind foot 12; ear 10·5.

Skull: condylo-incisive length 20; greatest breadth 9·4; least interorbital breadth 4·5; length of palate 8; post-palatal length 9; greatest maxillary breadth 6·2; median depth of brain-case 4·7; length of upper tooth-row 8·5.

Hab. Olgerei River, British East Africa.

Type. Adult male. B.M. no. 12. 7. 1. 68. Original number 114. Collected and presented by A. Blayney Percival, Esq.

The much smaller size and cinnamon-brown colour separate this form very clearly from the other members of the *luna* group.

Group 18 (*argentata*).

Rather small-sized species. Colour above greyish or greyish brown. Second and third upper unicuspids about equal in size.

(71) *Crocidura argentata*, Sund.

Sorex argentatus, Sundevall, K. Vetensk.-Ak. Handl. ii. no. 10, p. 16 (1858).

Size less than in *luna*.

Colour of upper parts pale slaty grey washed with reddish brown ("neutral grey" speckled with "cinnamon-drab"); hairs of back with slaty bases, reddish-brown tips, and light grey subterminal rings, the reddish tips becoming more dominant in the worn pelage, but never to such a marked extent as in *hirta*. Flanks rather greyer, the colour merging gradually into the purer and lighter grey of the under surface; belly "neutral grey" washed with "snuff-brown." Backs of hands and feet dirty white or pale brown. Tail dark brown above, dirty white below; bristle-hairs not very numerous or conspicuous, evenly distributed over basal two-thirds.

Skull much smaller than that of *luna* or *electa*, rather shorter than in *martensi*, the junction of the lambdoidal and sagittal sutures fairly far forwards as in the *fumosa* group, brain-case broad and flat; interorbital region broad posteriorly. Tooth-row a little shorter than in *martensi*; second and third upper unicuspids about equal.

Dimensions of the type (as given by Sundevall):—

Head and body 75 mm.; tail 45; hind foot (c. u.) 13·5.

Dimensions of a series from Deelfontein:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♂	85	52	13
♂	77	52	12·5
♂	78	48	12·5
♀	73	48	12·5
♀	95	51	12·5

Skulls:—

	♂. mm.	♂. mm.	♂ mm.	♂. mm.	♀. mm.	♀. mm.
Condylo-incisive length	22·3	22·2	21·4	21·5	21·4	21
Greatest breadth	9·6	9·7	9·3	9·5	9·5	9·5
Least interorbital breadth ..	4·6	4·7	4·7	4·5	4·2	4·4
Length of palate	9·3	9·1	8·7	8·7	8·7	8·7
Postpalatal length	9·8	10·3	9·4	9·4	9·4	9·2
Greatest maxillary breadth ..	6·8	6·8	6·6	6·5	6·4	6·3
Median depth of brain-case ..	4·8	5	4·7	4·8	4·8	4·6
Length of upper tooth-row ..	9·4	9·3	9·1	9·1	9·1	8·9

Hab. Roodeval, Karroo.

The slaty-brown colouring and shorter skull distinguish this shrew from *martensi*; both *electa* and *luna*, which are rather similar in colour to *argentata*, are both larger and possess larger and heavier skulls.

(72) *Crocidura cyanea*, Duv.

Sorex cyaneus, Duvernoy, Mém. Soc. Hist. Nat. Strasb. ii. Supp. p. 2 (1838); Mag. Zool. p. 21, pls. xl. & xli. (1842).

A dark slate-grey coloured species, probably allied to *argentatus*.

The description and plate given by Duvernoy show that the colour is considerably more slaty and less rufous than in *argentata*; it is possible that the specimen was immature and in the slate-coloured pelage so often met with in young individuals. The coloured plate is too "artistic" to be of very much use, but it was evidently intended to represent a slate-grey shrew, such as is described by Duvernoy. Underparts rather paler than upper, but not markedly so. Backs of hands and feet dirty buff. Tail slender, not conspicuously paler on the ventral surface, bristle-hairs fairly numerous, evenly distributed throughout nearly the whole length of the tail.

Skull apparently much as in *argentata*.

Dimensions (as given by Duvernoy):—

"Le corps a 3 pouces 4 linges de long et la queue 2 pouces."

Hab. ". . . la rivière des Éléphants, au sud de l'Afrique."

The dark slaty colour readily distinguishes this shrew from *argentata*, which is considerably paler and washed with reddish brown.

(73) *Crocidura electa*, Dollm.

Crocidura electa, Dollman, Ann. & Mag. Nat. Hist. (8) vol. v. p. 175 (1910).

Allied to *argentata*, larger in size and darker in colour.

Hind foot considerably longer, measuring from 18 to 14·5 mm. in length.

Colour of dorsal surface darker and browner deep,,) mouse-grey" speckled with "clove-brown"), very much as in *luna*. Ventral surface more slaty; extremities and tail as in *argentata*.

Skull larger than that of *argentata*, brain-case higher; teeth all larger, third upper unicuspid a trifle broader than second. Last upper molar large. In general shape the skull more resembles that of *luna*, but is rather smaller and has not the square-angled brain-case so characteristic of *luna* and its allies.

Dimensions of the type (measured in the flesh):—

Head and body 78 mm.; tail 47; hind foot 13·5; ear 10.

Skull: condylo-incisive length 23·3; greatest breadth 10·3; least interorbital breadth 4·8; length of palate 9·9; postpalatal length 10·6; greatest maxillary breadth 7·2; median depth of brain-case 5·9; length of upper tooth-row 10·6.

Hab. Kamtoby, south of Lake Tanganyika. Altitude 4500 feet.

Type. Adult male. B.M. no. 9.12.4.15.

The darker colouring and larger skull and teeth readily distinguish this Tanganyika shrew from the South African *argentata*. Its near neighbour, *luna*, is considerably larger with longer tail, and possesses a larger skull with square-shaped brain-case and larger teeth.

(74) *Crocidura martensi*, Dobs.

Crocidura martensii, Dobson, Ann. & Mag. Nat. Hist. (6) vol. vi. p. 496 (1890).

Size medium small. Fur fairly long, hairs of back measuring 5–6 mm. in length. Colour above brown finely speckled with grey ("light greyish olive" washed with "Prout's brown"), the tint fading gradually on the flanks into the grey of the ventral surface. Backs of hands and feet brownish yellow. Tail fairly long and finely haired, brown above, whitish below; bristle-hairs not numerous, sparingly distributed over basal two-thirds, greyish in colour.

Skull rather long and narrow, not so flattened as in *argentata*; third upper unicuspid rather longer in transverse section than second.

Dimensions of the type (as given by Dobson):—

Head and body 75 mm.; tail 58; hind foot 13; ear 9.

Dimensions of three Zululand specimens which appear to belong to this species:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♂. Zululand	80	64	15
♂. "	81	60	14
♀. "	85	59	14

Skulls (♂ and ♀): condylo-incisive length 22·1, 22; greatest breadth 9·7, 9·7; least interorbital breadth 4·7, 4·7;

length of palate 9·4, 9·4; postpalatal length 9·7, 9·9; greatest maxillary breadth 7, 6·8; median depth of brain-case 5·2, 5·5; length of upper tooth-row 9·8, 9·6.

Hab. "Cape of Good Hope."

This species is distinguished from *argentata* by its longer tail, longer, narrower, and less flattened skull, and browner colour. From the following form *silacea*, *martensi* is distinguished by its larger size, longer fur and tail, and browner colour.

(75) *Crocidura silacea*, Thos.

Crocidura silacea, Thomas, Ann. & Mag. Nat. Hist. (6) vol. xvi. p. 53 (1895).

Allied to *pilosa*, but distinguished by its shorter fur, paler colour, and less hairy tail.

Size of body as in *pilosa*. Fur considerably shorter, hairs on back only 3–4·5 mm. in length; ears less hairy.

Colour above pale slaty grey, between "mouse-grey" and "hair-brown." Ventral surface rather paler and greyer. Backs of hands and feet pale brownish buff. Tail not so hairy as in *pilosa*, covered with very fine short hairs, brownish above, paler below; bristle-hairs less numerous and more evenly distributed, occurring along the tail to within 10 mm. of the tip, greyish in colour.

Skull a little smaller than that of *pilosa*, with slightly smaller teeth.

Dimensions of the type (in spirit) and three other specimens (measured in the flesh):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♀ (type)	65	44	12	9
♂. Zoutpansberg ..	72	55	12	..
♂. " ..	69	43	13·5	..
♂. Barberton Dist. .	76	56	12	..

Skull of topotype: condylo-incisive length 19·4; greatest breadth 8·8, least interorbital breadth 4; length of palate 7·8; postpalatal length 8·7; greatest maxillary breadth 6; median depth of brain-case 4·6; length of upper tooth-row 8·2.

Hab. Figtree Creek, De Kaap, Transvaal.

Type. Adult female. B.M. no. 93.11.26.29.

This species differs from *pilosa* in its shorter fur, paler colour, and less hairy tail.

(76) *Crocidura bovei*, Dobs.

Crocidura bovei, Dobson, Ann. Mus. St. Nat. Genova, v. p. 425 (1887).

Colour above light brown with a greyish tinge on the surface; below silvery grey slightly intermixed with brown. Backs of hands and feet and tail covered with short pale-coloured hairs, lower surface of tail whitish.

Skull about equal in length to that of *floweri*, larger than in *bicolor*; second and third upper unicuspids about equal, tooth-row rather short.

Dimensions of the type (as given by Dobson):—

Head and body 58 mm.; tail 47; hind foot 12; ear 8·5.

Skull: condylo-incisive length 18·5; greatest breadth 8; length of upper tooth-row 7·5.

Hab. Vivi, Lower Congo.

Type. Adult male. Museo Civico, Genoa.

It is probable that *bovei* is more closely allied to *silacea* than to the *bicolor* group.

(77) *Crocidura capensoides*, Smith.

Sorex capensoides, Smith, S. Afr. Quart. Journ. vol. ii. p. 62 (1833).

Size fairly small, probably allied to *silacea*.

Fur described as "moderately long"; in the type-specimen, now before me, the hairs on the back are 4–5 mm. in length. Unfortunately the type is very faded; the colour above is brownish grey finely speckled with greyish. Ventral surface paler and greyer, the transition from the darker dorsal coloration rather gradual. Backs of hands and feet pale brown. Tail finely haired, brownish above, paler below; bristle-hairs distributed over basal two-thirds, whitish in colour.

Skull badly broken, only the nasal and maxillary regions remaining intact. Teeth fairly large, larger than in the *bicolor* group, second and third upper unicuspids about equal.

Dimensions of the type (as given by Smith):—

Head and body 3 inches; tail (now broken) 1¾ inches.

The hind foot measures 10·7 mm. in length.

Skull: least interorbital breadth 4·2; length of palate 8; greatest maxillary breadth 5·7; length of upper tooth-row 8·5.

Hab. Near Cape Town.

Type. Adult. B.M. no. 45. 7. 3. 38.

Group 14 (*pilosa*).

Size medium small. Colour dark brown; fur very long; extremities and tail clothed with short, coarse, black hairs. Second and third upper unicuspids about equal in size.

(78) *Crocidura pilosa*, Dobs.

Crocidura pilosa, Dobson, Ann. & Mag. Nat. Hist. (6) vol. vi. p. 496 (1890).

A dark brown, medium small-sized species, with hairy tail.

Fur long, hairs on back measuring from 6 to 7 mm. in length.

Colour (from spirit-specimens) dark brown, slightly paler below. Backs of hands and feet blackish brown. Tail thickly covered with short, coarse, brownish-black hairs, rather paler on the lower side; bristle-hairs slender and numerous, densely packed together over basal two-thirds, brown in colour.

Skull smaller than that of *martensi* or *argentata*, with smaller teeth.

Dimensions of the type (as given by Dobson):—

Head and body 60 mm.; tail 48; hind foot 13·5; ear 7·5.

Skull: length 20; greatest breadth 9; length of upper tooth-row 8.

Dimensions of two spirit-specimens in the Museum Collection:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂. Transvaal......	59	46	13·5	7·5
♀. ,, ...	69	50	14·3	7·7

Skulls (broken): least interorbital breadth 4, 4·2; length of palate 8, 8·5; greatest maxillary breadth 5·8, 5·9; length of upper tooth-row 8·5, 8·9.

Hab. Transvaal.

The chief distinguishing characters of this species are the long fur, the dark brown colouring, and the short, blackish, coarse hairs on the tail.

Group 15 (*fumosa*).

Size medium. Colour above dark brown, grey, or blackish. Third upper unicuspids broader than second.

(79) *Crocidura fumosa*, Thos.

Crocidura fumosa, Thomas, Ann. & Mag. Nat. Hist. (7) vol. xiv. p. 238 (1904).

Rather smaller than *turba*, with flatter, more delicately built skull.

Size of body rather small, between 78 and 84 mm. in length.

General colour of dorsal surface dark smoky brown (between "fuscous" and "sepia") mottled all over with greyish buff; the colour varies slightly according to the pelage, the type and topotypes in the Collection are evidently in the more bleached pelage, the colour being rather redder than in a series from the Aberdare Mountains, in which the specimens are all rather less red. Ventral surface a little paler, hairs dark slate-grey, with greyish-brown or vandyke-brown tips. Lateral gland small and usually inconspicuous. Flanks as dark as back, the colour gradually merging into the dark greyish-brown tint of the belly. Backs of hands and feet brownish or dirty white. Tail rather long, cylindrical, well provided with bristle-hairs; dark brown above, a shade lighter below.

Skull very delicately built, the general appearance much less solid than is usually the case in species of this size, rather short and with broad, flat, smooth brain-case, the greatest breadth of which is formed by a lateral angular expansion of its sides. In *turba* the sides of the brain-case do not present this angular expansion. Sagittal and lambdoidal sutures never forming any marked crests, their median junction more anterior than in *turba*. Maxillary region narrow, palate rather short. Teeth small, second upper unicuspid considerably smaller than third and slightly overlapped by it.

Dimensions of type, topotypes, and specimens from other localities:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♂ (type). Kenya	82	57	15
♂. Kenya	86	62	15·5
♀. ,, ...	90	55	15
♂. Mt. Elgon	76	54	15
♂. ,, ...	76	56	14
♀. ,, ...	77	52	14·5
♀. ,, ...	72	63	15
♀. ,, ...	73	53	15
♀. Jombeni Range	82	59	15
♂. Aberdare Mts.	84	56	14
♂. ,, ,, ...	83	53	15·5
♂. ,, ,, ...	84	52	15
♀. ,, ,, ...	84	52	14·5
♀. ,, ,, ...	81	52	14·5
♀. ,, ,, ...	84	58	14
♀. ,, ,, ...	81	53	15·5

Skull-dimensions of type and seven adults :—

	Mt. Kenya.		Aberdare Mts.				Mt. Elgon.	
	♂ (type).	♂.	♂.	♂.	♀.	♀.	♀.	♀.
Condylo-incisive length ..	22	21·5	21·5	21·4	21·6	21	21·8	21
Greatest breadth	10·1	10·4	10·1	9·9	10·1	9·8	10·2	9·9
Least interorbital breadth.	4·9	5	4·9	4·8	4·9	4·9	4·7	4·6
Length of palate	8·6	8	8·6	8·6	8·4	8·3	8·8	8·3
Postpalatal length	9·7	9·3	10	9·2	9·7	9·6	9·7	9·1
Greatest maxillary breadth	6·7	6·3	6·5	6·3	6·3	6·2	6·8	6·2
Length of upper tooth-row.	9·4	9·3	9·3	9·1	9	9	9·5	9

The examination of a large series of specimens from various localities in British East Africa shows that this species, while exhibiting a certain amount of individual variation in size, cannot be split up into geographical races to the same extent as in the *turba* group. There does not appear to be any sexual variation at all.

Hab. Western slope of Mt. Kenya. Altitude 7800 feet.

Type. Adult male. B.M. no. 0.2.1.8.

This Kenya species is represented in the Museum Collection by a small series from the type-locality, a large number of specimens from the Aberdare Mountains, a few from Mt. Elgon, and a single specimen from the Jombeni Range (Nyeri District), British East Africa.

The curiously delicately built smooth skull and respective sizes of the upper unicuspids render this species quite distinct.

(80) *Crocidura fumosa montis*, Thos.

Crocidura fumosa montis, Thomas, Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 138 (1906).

Size as in *fumosa*, but darker in colour and with more solidly built skull.

Fur rather longer than in the Kenya species. General colour dark slate-grey ("fuscous black" mixed with "black"), much less brown than in *fumosa*, and minutely speckled with silvery grey. Ventral surface very dark, slate-grey washed with vandyke-brown. Backs of hands and feet dirty brown. Tail long and slender, dark brown above, lighter below.

Skull like that of *fumosa*, but with a rather higher brain-case and narrower upper unicuspids.

Dimensions of the type and four topotypes (measured in the flesh):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♀ (type)	77	61	15
♀	86	60	15
♀	76	..	15
♂	80	59	15·5
♂	83	64	14·5

Skull of type: condylo-incisive length 21·7; greatest breadth 10·1; least interorbital breadth 5·3; length of palate 9; postpalatal length 9·7; greatest maxillary breadth 6·8; median depth of brain-case 6·8; length of upper tooth-row 9·6.

Hab. Ruwenzori East. Altitude 7000–12,500 feet.

Type. Adult female. B.M. no. 6. 7. 1. 28.

There is a certain amount of colour-variation exhibited by this species; in some cases the fur is nearly pure black, with the ventral surface scarcely paler; in the type and two other specimens the tint is considerably lighter and greyer, a condition which may be due to either age or seasonal change.

(81) *Crocidura fumosa schistacea*, Osg.

Crocidura fumosa schistacea, Osgood, Field Mus. Nat. Hist., Publication 148 (Zool. Ser.), vol. x. no. 3, p. 20 (1910).

In size equal to *fumosa*, but paler and less brown in colour.

Upper parts dark mouse-grey with light silvery ticking; ventral surface considerably paler than in *fumosa*. Backs of hands and feet paler. Tail more distinctly bicolor.

Dimensions of type (as given by Osgood):—

Head and body 93 mm.; tail 52; hind foot (c. u.) 15.

Skull: condylo-incisive length 23·1; greatest breadth 10·1; postpalatal length 10·6; length of upper tooth-row 10·2.

Hab. Lukenya Mountains (Ulu Kenya Hills), British East Africa.

Type. Adult female. Field Mus. Nat. Hist. no. 16884.

The greyer colour and rather larger skull separate this race from the true *fumosa*.

(82) *Crocidura fumosa selina*, subsp. n.

Size about as in *fumosa*.

Fur not very long, hairs of back about 5 mm. in length.

Colour (from spirit-specimen) very much the same as in true *fumosa*, dark slate-grey washed over with sepia and speckled with pale buff, browner than in *raineyi*. Ventral surface greyer, less brown, but not very much paler than upper parts. Lateral gland marked by a streak of short brownish hairs. Backs of hands and feet brown. Tail as in *fumosa*.

Skull with broad maxillary region. Teeth all larger and heavier, third upper unicuspid exceptionally large, considerably broader than in *fumosa*, oval in section, and much larger than the second.

Dimensions of the type (in spirit):—

Head and body 86 mm.; tail 58; hind foot 15; ear 10.

Skull (broken): length of palate 10; greatest maxillary breadth 7·5; length of upper tooth-row 10·5; horizontal dimensions of third upper unicuspid—length 1·3, breadth 1.

Hab. Mabira Forest, Chagwe, Uganda.

Type. Adult male. B.M. no. 8. 10. 27. 3.

The much greater size of the third upper unicuspids immediately separate this form from *fumosa*.

(83) *Crocidura fumosa johnstoni*, subsp. n.

Closely related to the Uganda race described above, the third upper unicuspids nearly as broad, more rounded in shape.

Size rather larger than in *fumosa*, but not to any marked extent. Fur long, hairs of back 8 mm. in length.

Colour (from spirit-specimen) of dorsal surface dark blackish brown, below rather greyer. Hands and feet as in *fumosa*. Tail very similar, a little paler below; bristle-hairs fairly numerous.

Skull larger than that of *fumosa* and more stoutly built; junction of lambdoidal and sagittal sutures almost as far forward. Teeth all much heavier, larger than in *selina*, excepting the second and third upper unicuspids, which are rather smaller, third much larger than in *fumosa*. In this Nyasa shrew the large upper premolar is not in contact with the posterior border of the third unicuspid; in the Uganda race the two teeth just touch one another.

Dimensions of the type (in spirit):—

Head and body 81 mm.; tail 56; hind foot 15·5; ear 10.

Skull: condylo-incisive length 24·7; greatest breadth 10·9; least interorbital breadth 5·2; length of palate 10·2; post-palatal length 11·1; greatest maxillary breadth 7·8; median depth of brain-case 5·7; length of upper tooth-row 10·9; horizontal dimensions of third upper unicuspid—length 1, breadth ·9.

Hab. Chiromo, Nyasaland.

Type. Adult male. B.M. no. 93. 5. 2. 47. Collected by Mr. A. Whyte and presented by Sir Harry Johnston.

The larger skull and much larger size of the third upper unicuspids separate this Nyasa race from the East-African *fumosa*; the Uganda form, *selina*, has shorter fur, a rather shorter tooth-row, and rather larger upper unicuspids.

(84) *Crocidura raineyi*, Hell.

Crocidura raineyi, Heller, Smith. Misc. Coll. vol. lx. no. 12, p. 7 (1912).

Larger than *fumosa*, with heavier skull, larger teeth, and much paler and greyer in colour.

General colour like a light shade of that seen in *montis* (between "fuscous black" and "*Chætura* drab" mixed with "neutral grey"), the brown tint only faintly developed, much less dominant than in true *fumosa*; silver-grey ticking very conspicuous. Ventral surface slightly lighter, lacking the silver speckling of the upper parts. Backs of hands and feet dirty white. Tail indistinctly bicoloured, light brown above, paler below, caudal bristle-hairs slender and light-coloured.

Skull much more strongly built than in *fumosa*; brain-case shaped as in *luna*, anterior corners square. Teeth larger, the third upper unicuspid broader than the second in transverse section.

Dimensions of the type (as given by Heller):—

Head and body 90 mm.; tail 61; hind foot 15·5.

Skull: condylo-incisive length 23·3; greatest breadth 10·7; length of upper tooth-row 11.

Hab. Mt. Gargues (Mt. Urguess). Altitude 6000 feet.

Type. Adult female. U.S. Nat. Mus. no. 181816.

In the Museum Collection there are two topotypes of this interesting shrew, collected and presented by A. Blayney Percival, Esq. Both these specimens agree with Heller's description very closely. The following are the dimensions (measured in the flesh) of these specimens:—

♀ ♀. Head and body 88, 92 mm.; tail 54, 54; hind foot 15·5, 16.

Skull of one of the Museum specimens:—

Condylo-incisive length 24·5; greatest breadth 10·5; least interorbital breadth 5·4; length of palate 10; postpalatal length 10·9; greatest maxillary breadth 8; length of upper tooth-row 11.

The pale slate-grey pelage and larger cranial dimensions render this species quite distinct from *fumosa*.

Group 16 (*jacksoni*).

Size fairly small. Colour above greyish or dark brown. Third upper unicuspids broader or almost the same size as second.

(85) *Crocidura parvipes*, Osg.

Crocidura parvipes, Osgood, Field Mus. Nat. Hist., Publication 143 (Zool. Ser.), vol. x. no. 3, p. 19 (1910).

A medium small-sized brownish-fawn coloured species, with whitish underparts and short tail.

Size of body about as in *lutreola*; hind foot small.

Colour above brownish fawn speckled with drab-grey; ventral surface white tinged with creamy, the bases of the hairs slate-grey; line of demarcation between the brown upper parts and the white of the belly sharp. Feet whitish. Tail brownish above, whitish below.

Skull about equal in size to that of *jacksoni amalæ*, larger than in *bicolor*, third upper unicuspid slightly larger than second, but appearing smaller in lateral view, since its posterior third is hidden by the anterior cusp of the large premolar.

Dimensions of the type (as given by Osgood):—

Head and body 84 mm.; tail 38; hind foot 11·5.

Skull: condylo-incisive length 20·7; greatest breadth 9·5; greatest maxillary breadth 7·1; length of upper tooth-row 8·7.

Hab. Voi, British East Africa.

Type. Adult male. Field Mus. Nat. Hist. no. 16890.

In general dimensions this species would appear to be nearest *sansibarica*, but the ventral surface is considerably paler and whiter.

(86) *Crocidura sansibarica*, Neum.

Crocidura bicolor sansibarica, Neumann, Zool. Jahrb. Abth. Syst. vol. vi. p. 544 (1900).

Size of body larger than in *bicolor*.

Colour above brown washed with cinnamon, below greyish brown.

Dimensions of the type (as given by Neumann):—

Head and body 86 mm.; tail 40.

Hab. Mojoni, Zanzibar Island.

This Zanzibar shrew would appear to be considerably larger than *bicolor* and the allied races; in general body-dimensions it is more as in *parvipes* from Voi; probably it is more nearly allied to this form than to *bicolor*, and is here treated as a separate species.

(87) *Crocidura xanthippe*, Osg.

Crocidura xantippe, Osgood, Field Mus. Nat. Hist., Publication 143 (Zool. Ser.), vol. x. no. 3, p 19 (1910).

Size rather larger than in *jacksoni*.

Colour above "fawn-colour with a fine vermiculation of lighter (almost ecru-drab)"; ventral surface dull greyish white. Backs of hands and feet white. Tail dusky brown above, below whitish for proximal two-thirds, dusky for terminal third.

In the Museum Collection are four specimens, two from Voi and two from Taveta, which I have accepted as representing this species. They are rather darker in colour than Osgood's type, but very similar in dimensions.

Skull rather longer than in *jacksoni*, brain-case larger. Small upper unicuspids almost equal, second a trifle smaller than third.

Dimensions of the type (as given by Osgood):—

Head and body 90 mm; tail 60, hind foot 15.

Skull: condylo-incisive length 22; maxillary width 6·8; length of upper tooth-row 9·6.

Hab. Voi, British East Africa.

Type. Adult male. Field Museum Nat. Hist. no. 16888.

Distinguished from *jacksoni* by its paler and more fawn-coloured pelage.

The original spelling of the specific name is presumably a misprint.

(88) *Crocidura jacksoni*, Thos.

Crocidura jacksoni, Thomas, Ann. & Mag. Nat. Hist. (7) vol. xiv. p 238 (1904).

Size medium small, hind foot from 12 to 13 mm. in length.

General colour of dorsal surface smoky grey conspicuously mottled with silvery grey, resulting effect represented by "fuscous" mottled with "clove-brown" and silvery grey; flanks less brown, the tint fading gradually into the lighter grey colour of the ventral surface. Lateral glands not so obvious as in some of the allied species, but marked with a streak of short whitish hairs. Hands and feet dirty buff. Tail more hairy than in *hildegardeæ*, caudal bristle-hairs grey and numerous; above brownish grey, dirty buff or whitish below.

Skull like a small edition of that of *fumosa*, brain-case not quite so broad proportionally; interorbital region thick. Teeth smaller than in *fumosa*; third upper unicuspid a trifle broader in transverse section than second; in the type these two teeth are almost equal in size, the second being triangular in section and the third a trifle longer and heart-shaped.

Dimensions of the type (taken from the dry skin):—

Head and body 73 mm.; tail 51; hind foot (moistened) 13.

The dimensions of the tail and hind foot of three topotypes in the collection are respectively 45, 47, 48 mm.—13·5, 12·5, 12.

Skull of type and two topotypes:—

	♀ (type). mm.	♀ (topotype). mm.	(Topotype). mm.
Condylo-incisive length..........	21·1	20·7	21
Greatest breadth	9·2	9·1	9
Least interorbital breadth	4·4	4·5	4·5
Length of palate	8·5	8·5	8·5
Postpalatal length	9·6	9	8·9
Greatest maxillary breadth	6·5	6·6	6·5
Median breadth of brain-case . ..	5·3	5·2	5·2
Length of upper tooth-row	9·2	9·2	9·4

Hab. Ravine Station, British East Africa.

Type. Adult female. B.M. no. 99.8.4.27.

(89) *Crocidura jacksoni amalæ*, subsp. n.

Closely allied to *jacksoni*, but distinguished by its darker colour and the entire absence of the silvery-grey mottling so conspicuous in the Ravine form.

Size rather less, hind foot 12 mm. in length.

Colour of dorsal surface dark brownish finely speckled with pale buff, the general effect as in "mummy-brown" mixed with "sepia"; flanks paler, the brownish tint passing more abruptly into the light grey of the ventral surface. Backs of hands and feet a shade darker than in *jacksoni*. Tail equally hairy; distinctly bicoloured, dark brown above, white below.

Skull rather smaller and narrower than in *jacksoni*;

second and third upper unicuspids markedly smaller, third a trifle larger than second; shape of teeth as in *jacksoni*.

Dimensions of the type (measured in the flesh):—

Head and body 68 mm.; tail 47; hind foot 12; ear 10.

Skull: condylo-incisive length 20; greatest breadth 8·7; least interorbital breadth 4; length of palate 8; postpalatal length 9; greatest maxillary breadth 6; median depth of brain-case 5·2; length of upper tooth-row 8·3.

Hab. Amala River, Nyanza Province, British East Africa. Altitude 5500 feet.

Type. Adult male. B.M. no. 13. 10. 18. 24. Original number 50. Collected on October 16th, 1912, by W. P. Lowe, Esq.; presented by G. P. Cosens, Esq.

Mr. Lowe obtained a second specimen of this small shrew at Lengototo, S.W. Nyanza Province; it agrees very closely with the type in general colour and the dental characters noted above.

The browner colour, absence of silver-grey mottling, more distinctly bicoloured tail, and smaller unicuspids are the chief characters that serve to distinguish this new form from the Ravine species.

(90) *Crocidura jacksoni denti*, subsp. n.

About equal in size to *jacksoni*.

Fur of medium length, hairs on back 3–4·5 mm. in length.

Colour (from spirit-specimen) dark brown above, slaty grey below. Backs of hands and feet brownish. Tail dark brown above, slightly paler on the ventral surface; bristle-hairs fairly numerous on basal two-thirds.

Skull about equal in size to that of *jacksoni*, but with a rather larger brain-case, the anterior corners of which are very much more rounded. Small upper unicuspids more equal in size, the third only slightly broader than the second.

Dimensions of the type (in spirit):—

Head and body 63 mm.; tail 46; hind foot 13; ear 8.

Skull: condylo-incisive length 20 6; greatest breadth 9·3; least interorbital breadth 4·5; length of palate 8·5; postpalatal length 9·2; greatest maxillary breadth 6·6; median depth of brain-case 5·1; length of upper tooth-row 9.

Hab. Between Mawambi and Avakubi, Ituri Forest, Congo.

Type. Adult female. B.M. no. 7. 1. 2. 13. Collected during the Ruwenzori Exploration by Mr. R. E. Dent.

This Ituri race is distinguished from *jacksoni* by its darker body-colour, darker extremities and tail, more rounded brain-case.

(91) *Crocidura macowi*, sp. n.

Richer in colour than either *jacksoni* or *lutreola*.

Size of body and hind foot about the same; tail a little longer.

Upper parts dark brown ("mummy-brown" mixed with "raw umber"), the colour passing fairly abruptly into the slate-grey of the belly. Hands and feet rather darker, dirty brown. Tail more hairy than in *lutreola*, about as in *jacksoni*, but longer; dark brown above, a shade paler below.

Skull smaller than in *jacksoni*, about equal to that of *lutreola*, muzzle rather blunt; anterior corners of brain-case about as in *jacksoni*. Second upper unicuspid triangular in transverse section, third rather heavier and squarer in section.

Dimensions of the type (measured in the flesh):—

Head and body 71 mm.; tail 58; hind foot 13·5; ear 9·5.

Skull: condylo-incisive length 19·7; greatest breadth 9; least interorbital breadth 4·6; length of palate 7·8; post-palatal length 9; greatest maxillary breadth 6·2; median depth of brain-case 4·9; length of upper tooth-row 8 3.

Hab. Mt. Nyiro, S. of Lake Rudolf.

Type. Adult male. B.M. no. 12. 7. 1. 65. Original number 393. Collected and presented by A. Blayney Percival, Esq.

In addition to the type Mr. Percival obtained a second specimen of this interesting little shrew at the same locality; it agrees very closely with the type in colour and dimensions (♀. Head and body 68 mm.; tail 57; hind foot 13; ear 8·5).

✱

(92) *Crocidura gracilipes*, Pet.

Crocidura gracilipes, Peters, MB. Akad. Berlin, p. 584 (1870).

Size about as in *jacksoni*, colour browner without the grey mottling, more as in *lutreola*, but with the second and third upper unicuspids about equal in size.

General colour cinnamon-brown (between "mummy-brown" and "fuscous"), with none of the silver-grey mottling so evident in *jacksoni*; flanks slightly paler and greyer than back. Lateral glands small, marked by short whitish hairs. Underparts grey washed with buffish brown.

rather paler and greyer in the new unbleached coat. Backs of hands and feet brownish buff. Tail long and slender, clothed with much shorter and less conspicuous hairs than in *jacksoni* or *j. amalæ*, appearing almost naked except for the bristle-hairs, which are very inconspicuous; colour dark brown above, a shade paler below, very different from the distinctly bicoloured tail of *amalæ*.

Dimensions of the type (as given by Peters):—

Head and body 65 mm.; tail 52; hind foot 13 (c. u.).

Skull: length of upper tooth-row 8·7.

Hab. Kilimanjaro.

In the Museum Collection there are three specimens which appear to represent this species, one from Rombo (Kilimanjaro), and two from Taveta. The dimensions of these individuals are as follows:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♀. Kilimanjaro	66	50	12·2
♀. Taveta	74	44	12
♀. "	70	45·5	12

Skulls of Taveta specimens: condylo-incisive length 20, 20; greatest breadth 8·9, 9; least interorbital breadth 4·1, 4·3; length of palate 8·5, 8·3; postpalatal length 8·9, 8·8; greatest maxillary breadth 6·1, 6·1; median depth of brain-case 4·7, 4·7; length of upper tooth-row 8·8, 8·5.

The skulls are rather smaller than in *jacksoni*, about equal in size to *hildegardeæ*. Teeth small, second and third upper unicuspids about equal, heart-shaped in section, the apex of the third pointing slightly inwards and overlapping the internal posterior angle of the second. Last upper molar narrower than in *jacksoni*.

There is only one point in which these three specimens do not agree with the description given by Peters, and that is as regards the relative sizes of the fore and hind claws. Peters states that the fore claws are longer than the hind ones; in the Museum specimens the fore and hind claws are about equal in size. The difference is evidently only a small one, as no measurements are given. An examination of large series of specimens of other species tends to show that there exists a certain amount of variation in the relative sizes of the fore and hind claws; on this account it seems best to accept provisionally these specimens as representing *gracilipes*, it being impossible, owing to the European War, to settle the matter definitely by application to Berlin.

From *jacksoni* this species is distinguished by its smaller narrower skull, smaller unicuspids, less hairy tail, and browner-coloured upper parts. The dark almost uniformly coloured tail separates it externally from the Amala race of *jacksoni*; the almost equal size of the second and third unicuspids distinguish it at once from *lutreola*, in which these teeth are as unequal in size as in the *fumosa* group.

(93) *Crocidura lutreola*, Hell.

Crocidula lutreola, Heller, Smith. Misc. Coll. vol. lx. no. 12, p. 8 (1912).

Closely allied to *jacksoni*; in colour very like *j. amalæ*, but with darker, not distinctly bicolor tail, and having the third upper unicuspid almost twice the size of the second, in this respect agreeing with some members of the *fumosa* group.

Size of body and hind foot about as in *jacksoni*.

Colour of dorsal surface seal-brown ("sepia"), flanks equally dark; no grey mottling on the back or flanks. Ventral surface grey washed with brown. Backs of hands and feet brownish. Tail dark seal-brown above, a shade lighter below, but not distinctly bicoloured.

Skull like that of *jacksoni*, but narrower across the maxillary region; second upper unicuspid markedly smaller than third, much more so than in any of the other members of this group, third very broad almost square-shaped in section. In general build the skull is most like that of *gracilipes*, but the brain-case is higher.

Dimensions of the type (as given by Heller):—

Head and body 70 mm.; tail 52; hind foot 12·5.

Skull: condylo-incisive length 19; greatest breadth 8·7; length of upper tooth-row 8.

Hab. Mt. Mbololo, Taita Hills, British East Africa. Altitude 5000 feet.

Type. Adult female. U.S. Nat. Mus. no. 181818.

The only specimen of *lutreola* in the Museum Collection is one from the Tsavo River, the coloration and size of the upper unicuspids are exactly as described by Heller. The dimensions of this Tsavo specimen are as follows:—

Head and body 68 mm.; tail 50; hind foot 13.

Skull: condylo-incisive length 20·7; greatest breadth 9·3; least interorbital breadth 4·3; length of palate 8·8; postpalatal length 9; greatest maxillary breadth 6·2; median depth of brain-case 5; length of upper tooth-row 8·7.

The exceptionally large size of the third upper unicuspids render this species quite distinct from all the allied forms.

[To be continued.]

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XLVI.—*Some Protozoa from Fishes occurring in the Vicinity of Cullercoats, Northumberland.* By THOMAS BENTHAM, B.Sc. Oxon., M.Sc. Dunelm., Demonstrator in Zoology, University of Durham.

[Plates XVI. & XVII.]

IN August last the following North-Sea fish were examined for blood-parasites. The results are given in the annexed table:—

Name of Fish.	Number examined.	Number with Parasites.
Gadus virens	11	0
Pholis gunnellus	5	0
Blennius pholis	6	0
Zoarces vivipara	2	2. *Hæmogregarina bigemina.*
Cottus scorpius *	6	3. —— *cotti.*
Gobius ruthensparri	2	0
Pleuronectes platessa ...	5	0
——*flesus*	2	0
Liparis montagui.	1	0
Motella mustela	3	0
omber scomber	10	4. Parasites.
Raia batis.	1	1. *Hæmogregarina* sp.

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* On the three infected specimens *Calliobdella punctata*, the *Cottus*-leech, was found.

All the above specimens were obtained in the vicinity of Cullercoats, and it will be seen that the results were rather disappointing, ten fish only being infected out of fifty-four examined. This scarcity of parasites may be partly accounted for by the fact that a great many of the fish were young and consequently had not acquired any external parasites, and also by the fact that some, as the eleven *Gadus virens*, had been in the aquarium for over a year, so that external parasites would have a difficulty of access to them.

External parasites were not found on any of the fish except *Cottus scorpius*, and the three which were infected with Hæmogregarines all had leeches upon them. The viviparous blennies, mackerel, and skate were infected, although no external parasites were present.

It has been suggested to me that mackerel, when they are not found on these coasts, possibly go far out to sea and become bottom-feeders. In this stage of their life parasitic leeches would have easy access to them. On the other hand, *Caligus scombri*, a parasitic copepod found commonly on mackerel, may possibly act as the invertebrate host. In the case of the blennies the intermediate host is probably a leech closely allied to *Calliobdella punctata*, and mentioned by Van Beneden in his description of that species. In the case of *Raia batis*, the intermediate host is probably the skate-leech, *Pontobdella muricata*.

Technique.

All smears of blood, spleen, liver, and gut-contents of leeches were fixed in osmic acid (3 °/₀ sol.) to which a few drops of glacial acetic acid had been added. They were further fixed in alcohol for a quarter of an hour, and finally stained with Giemsa's modification of the Romanowsky stain, afterwards being differentiated with orange tannin and acetone. Leishman's modification was used with good results, the mixed stain and water being allowed to remain on the slide for upwards of half an hour. Infusoria were examined alive, and sometimes stained *intra vitam* with weak methylene blue. Smears of Infusoria were made and allowed to dry slowly in the air. Violent heating was found to dry up and destroy the shape of the organisms. Staining with Leishman was found quite effective, the cytoplasm and nuclei of the cells exhibiting the usual Romanowsky reaction.

HÆMOSPORIDIA.

Parasites of Cottus scorpius (*the Father Lasher*).

Six members of the above species were examined for blood-parasites, and of these three contained *Hæmogregarina cotti*, Brumpt et Lebailly, in small numbers. The parasites exhibited the usual Hæmogregarine characters, were large, and in nearly all cases curled round upon themselves (see Pl. XVI. fig. 1, *1*). They were nearly always present in the erythrocytes, but in one case a parasite was found in an erythroblast. A large number of the organisms were found to be free in the plasma, but this was, no doubt, due to an artifact when the smears were made.

In size the parasite measured about 12 μ by 4 μ, although smaller forms were observed. No cases of double infection were ever observed, and in this the Hæmogregarine differs from that found in the blood of blennies and skates. Metachromatinic grains were commonly present, and there was always a distinct capsule in the blood-corpuscle surrounding the parasite. The edge of this capsule can be readily seen in the figure.

Examination of spleen-smears of the *Cottus* disclosed several small Hæmogregarines of a type differing from those found in the peripheral blood. These forms were of the typical bean-shape, slightly bowed, and with a large diffuse nucleus. They measured about 10 μ in length by 3 μ in breadth at the widest part of the cell-body. These evidently corresponded to the trophozoites and schizonts of other nearly allied groups. In a good many cases distinct fragmentation of the nucleus could be made out, and parasites of the rosette type were to be found. The picture presented was very much like that of the schizogony of *Coccidium*—of course, on a smaller scale.

With a view to finding out whether *Calliobdella punctata*, the *Cottus*-leech, was the invertebrate host of *Hæmogregarina cotti*, some smears of the gut and sections of the body of the leech were made. The results were, on the whole, satisfactory. Gut-smears were found to contain the Hæmogregarines in fair numbers. These organisms were all found in a free state, the hæmolysin in the gut of leech being evidently a powerful one—at any rate, towards the erythrocytes of the fish. In all the smears prepared, perhaps only three or four intact red-cells were found, the others having been hæmolysed. The parasites, however, are seemingly quite resistant to the influence of the hæmolysin, and fall distinctly into two categories. Short forms are present of the usual Hæmogregarine type, namely, bean-shaped and rounded at both ends, with a more or less centrally placed nucleus of the diffuse type. They measure roughly 10 μ in length by 3 μ in breadth, and *inter se* do not vary very much in size. These forms were taken to be the microgametocytes, or those destined to give rise to the male forms of the parasite. They were further characterized by being free from all metachromatinic or volutin granules, and in this character they differ from the intra- and extra-cellular parasites found in the peripheral blood of *Cottus* (see Pl. XVI. fig. 1, *3 b*). The female elements or macrogametocytes were elongate vermicular forms—as a rule, about 15 μ by 2 to 3 μ in measurement, and having a compact vesicular nucleus situated about the middle of the cell-body. This nucleus usually contained a large distinct karyosome situate within the organ. No external chromatin grains were to be seen, and, as in the microgametocytes, the cytoplasm was free from volutin. The rest of the life-history in the leech could not be made out with certainty, but there were present in the gut a fair number of large rounded bodies having a more or less compact nucleus. In some cases what appeared to be an extrusion of karyosomes could be made out. These large forms were taken to be macrogametocytes which had passed into the macrogamete stage. No stages of the formation of microgametes could be seen (see Pl. XVI. fig. 1, *2 a* & *2 b*).

It was at first thought that the elongate vermicular forms might possibly be Crithidial stages of Trypanosomes present in the leech-gut, and to this end smears were stained with iron hæmatoxylin. With this process the structure of the nucleus was seen to approximate more closely to the usual Hæmogregarine type, rather than to the appearance of the same structure in a Trypanosome. From these observations it is therefore fairly evident that schizogony takes place, not in the blood of *Cottus*, but in the spleen, the gamogonous cycle taking place in the gut of the invertebrate host. It is also evident that the spores of the genus *Hæmogregarina* are very resistant of death and dissolution in the invertebrate host, since they seem to persist for a very long time in the dorsal blood-vessel of the leech. This is substantiated by the following facts. A cat-fish (*Anarrhichas lupus*) was caught on one of our trawling-trips near Holy Island on June 25th, 1913. Several specimens of the leech *Ichthyobdella anarrhichæ* were taken from the gills and placed in a glass vessel in the aquarium. These leeches were kept without any food until the 30th of July, and were still alive when some were taken out and preserved in alcohol. Sections were cut and stained with Giemsa, and, although the leeches had not been on a fish for thirty-five days, their dorsal blood-vessels were found to be crammed with parasites, which were taken to be sporozóites of *Hæmogregarina* (see Pl. XVI. fig. 2). Examination of the gut proved negative. There was not a trace of a blood-cell of any kind left, the gut being full of bacilli, the most common being a short slender rod.

The account given by Reichenow of the development of the Hæmogregarine of the tortoise does not in the initial stages correspond with my observations in *Cottus*. There was no evidence in the spleen of the fish of the two arms of the parasite fusing to form a bean-shaped macroschizont. It is more than likely that the parasite is liberated in the blood as a free vermicule, where it finds its way to the spleen after the manner of a "schizokinete." The fusion of the two arms of a parasite was never seen either in the blood of the fish or in its spleen (see Minchin & Woodcock).

A large tumour, evidently a Hæmangioma, was found on one of the infected *Cottus*, and, although many of the blood-cells in this tumour contained Hæmogregarines, it would be difficult to say whether or no they were the cause of the growth.

Parasites of Scomber scomber (*the Mackerel*).

For examination for blood-parasites ten mackerel were obtained at Cullercoats on August 26th, 1915. The fish varied in size from 26·4 cm. to 32·0 cm. No external parasites were found on them.

Only blood-smears were taken from each fish, since previous examinations had been so disappointing, and it was not thought worth while to make smears of spleen, swim-bladder, etc.

Four of the ten mackerel were found to be infected with blood-parasites. Two individuals of these four were infected with different parasites, whilst the other two were infected with both of the parasites. Before going into details in regard to the morphology of these parasites, it may perhaps be of service to give a short description of the cellular elements of the blood of a fish such as the mackerel. These elements fall naturally into two groups—erythrocytes and leucocytes—the former constituting by far the greater portion of the corpuscles in the plasma. Erythrocytes in the mackerel are oval in contour, rather more pointed at their ends than those of other fish, and measure roughly 12–13 μ in length by about 9 μ in breadth. About the centre of the cell-body is a comparatively small nucleus, staining dark blue. Besides these elements are a certain number of erythroblasts or immature red-cells. These are characterized by being slightly smaller and more rounded than the erythrocytes, and by staining blue instead of, as in erythrocytes, pink by the Romanowsky method. The nuclei of these cells are comparatively larger than those of erythrocytes, but in no way approach the size attained by those in birds; hence they cannot possibly be confused with medium lymphocytes.

The leucocytes, if we include thrombocytes, are of six different kinds—small, medium, and large lymphocytes, eosinophils, mast-cells, and the thrombocytes above mentioned.

The lymphocytes are in smear preparations all rounded in shape, with a single nucleus which is always excentric in position in the cytoplasm. In the small and medium forms the nucleus occupies nearly the whole of the cell, there being merely a thin ring of cytoplasm round the edge. In the large forms the nucleus is relatively small, being in diameter not more than one-third of the diameter of the whole cell. The small forms measure only about 8 μ in diameter, the medium about 12 μ, and the large from 18–20 μ. In all, the cytoplasm stains pale blue, the nucleus purple, by the Romanowsky method, and they constitute about 15 °/ₒ of the cellular elements of the blood.

Eosinophils are small in the mackerel compared with those of other groups. They are rounded in shape and measure about 8 μ in diameter, have a single excentrically placed nucleus, and their acidophil granules are rounded and occupy a fairly large space of cytoplasm on one side of the nucleus. They are only slightly more numerous than the next type. Mast-cells are slightly larger than eosinophils. They stain a pale blue and do not seem to possess any nucleus. In place of this there are scattered about in the cytoplasm a moderate number of rounded, purplish, deeply staining granules which vary considerably in size. They occur very rarely in films, there being about one or two in each smear. Thrombocytes in fish are fairly constant in shape, and are to be recognized by both their elongated fusiform shape and their elongated centrally placed nucleus. They are in length about 12 μ, but only about 5 μ in breadth at their widest part. The nucleus measures about 7 μ by 5 μ, so that at its widest part it touches the edge of the cell-body. The cytoplasm stains blue and the nucleus dark blue. These cells are commonly found clumped together in groups; hence the common idea that they function in the clotting of the plasma. About 3 °/o are present.

The parasites in the blood of the mackerel are found in the medium lymphocytes and in the mature erythrocytes, and seem to be two totally different forms, although, as will be seen later, they may be only sexually differentiated forms of the same parasite. Occurring in the lymphocytes were oval forms, all within certain limits of the same size, viz., about 9 μ by 5μ (see Pl. XVII. fig. 1, *1* & *3*). They occupied the side of the lymphocytes where there was most cytoplasm, and compressed the nucleus, so that in larger forms this organ was represented as a mere rim at the edge of the host-cell. As a rule, however, the parasite occupied less than half the area of the host-cell. The cytoplasm of these organisms stained a fairly deep blue by the Romanowsky method, and was slightly vacuolated. At about the middle of the cell-body there was situated a large compact nucleus, containing a conspicuous organella or karyosome, which was sometimes situated some little way outside the nucleus.

A few metachromatinic granules were to be seen scattered in the cytoplasm. In some cases two parasites were found in a single lymphocyte, and these were always close together and on the same side of the host-cell nucleus (see Pl. XVII. fig. 1, *2*). A blood count showed about 3 °/o of the lymphocytes to be infected. These organisms bore a striking resemblance to the true rounded leucocytozoa found in the lymphocytes and erythroblasts of different species of finches. They were not in the least hæmogregarine-like, displayed no distinct capsule, and in their action towards the nucleus of the host-cell were very similar to *Leucocytozoon fringillinarum*. All the organisms were, moreover, of the same type, and seemed to be macrogametocytes. They occurred alone in one fish, not accompanied by the other parasites to be described, and were not found free in the plasma or in any other blood-cell. The organisms are interesting from the fact that they are the first of their kind to be demonstrated in the leucocytes of fish. As in birds, they were characterized by their comparative abundance in the blood—a characteristic but rarely found in the genus *Hæmogregarina*. Occurring together with the organisms above described in two other fish and by themselves in another fish, parasites of a different type were found in the erythrocytes (see Pl. XVII. fig. 1, *4* & *7*). These were smaller than the "*Lymphocytozoa*," and in general contour resembled small *Halteridia*, the parasite at its larger stages lying alongside the nucleus of the host-cell. The smaller forms were always definitely rounded in shape, resembled *Plasmodia*, and never more than two were to be seen in a single erythrocyte (see Pl. XVII. fig. 1, *5* & *6*). The largest were never more than 8 μ in length by about 3 μ in breadth at the widest part of the body. It was at first thought that, owing to their pale colour, they were merely capsules of some hæmogregarine that had left the host-cell; but, as no other forms were found anywhere else free in the plasma, and as also the cytoplasm, even after prolonged staining, was of the palest blue*, they were then taken to be definite parasites. Moreover, a small nucleus of the diffuse type could with difficulty be made out. This was very small, and not, as a rule, centrally placed, but occupied a place in the cytoplasm at one end of the cell-body. Sometimes, as in the other parasites, two forms were found in a single host-cell. These either lay side by side or overlapped one another when on one side of the nucleus; but they often occurred away from one another and on opposite sides of the nucleus. No metachromatinic granules were present in this organism. From the paleness of the coloration of these parasites and from their badly staining diffuse nucleus, it was at first thought that they were the microgametocytes of the forms found in the lymphocytes; but this seemed hardly likely, since they were found by themselves in one fish. Besides this, these forms were smaller and differed markedly from the others in shape and in their disposition towards the host-cell nucleus. It also seems inconceivable that two types of the same parasite should choose different host-cells.

It is a difficult matter to determine the true character of these parasites, but it seems that the organisms in the erythrocytes are, at any rate, Hæmogregarines, the character of the other specimens being decidedly uncertain.

Parasites of Raia batis (*the Common Skate*).

In the single fish examined a large number of small Hæmogregarines were found. They were so numerous in the blood that at least 10 °/₀ of the erythrocytes were found to be infected, and occasionally a few parasites were found free in the plasma. They were all small vermicular forms, measuring about 7 μ in length by about 2 μ in breadth. In some cases the parasites were pointed at both ends (see Pl. XVII. fig. 2, *1* & *2*), but more usually one end was rounded and the other pointed (see Pl. XVII. fig. 2, *4*). The nucleus was, as a rule, centrally placed, large, and compact. No forms were seen with a diffuse nucleus. A number of granules of volutin were present scattered about the cell-body, and usually two of these grains were larger than the rest and were present at the more pointed end of the parasite (see Pl. XVII. fig. 2, *1* & *4*). A distinct vacuolar space was sometimes present at the pointed end of the body, and was always close to the two organellæ above-mentioned. The capsule at both ends of the parasite was slightly thickened, but its edges were never evident. In a few instances two parasites were seen together in a single erythrocyte. These always lay parallel to one another, and were never far apart. In this character the parasite was very similar to *Hæmogregarina bigemina*, found in blennies, and no distinct difference could be discerned.

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* The paleness of the cytoplasm was reminiscent of that exhibited by certain Piroplasmata, but the nucleus was not nearly so prominent.

INFUSORIA.

While examining the blood of *Cottus scorpius* for parasites, an infusorian of the genus of *Trichodina* (Ehrenberg) was discovered on the gill-rakers. A blood-smear had been made from one of the gills and was stained with Leishman. On examination, the smear was found to contain numerous members of the above genus. The organism is closely related to *T. scorpæna* found on *Scorpæna* and *Trigla*, but differs markedly from that species in shape, size, and in the characters and disposition of the acetabulum.

Description of Organism. (See Pl. XVI. fig. 3.)

Shape a flattened cylinder, having a small conical projection on the aboral surface. Size about 80 μ across the oral disc, but varying within certain limits. The aboral surface also measures 80 μ in diameter. The thickness of the organism is about 50 μ, but this measurement varies slightly with the movement of the cytoplasm, although the shape of the cell-body is almost fixed. Diameter of acetabulum to its outer ring 30 μ. There is a strong band of oral cilia round the edge of the concave ventral surface, and running from the upper to the lower surfaces and destroying the complete contour of the cylinder, is a distinct wide and deep groove representing the anus. There are no aboral cilia, those of the oral contour, however, running down into the cytopharynx. Acetabulum much smaller than in *T. scorpæna*, about half as broad as long, and in optical section curved towards the oral pole, the concavity of the ring pointing towards that pole. Lip of acetabulum surrounded by two distinct concentric circles, which lie closely together. Uncini 28–30 in number, and lying between the two outer concentric circles and another circle which constitutes the edge of the cytopharynx. The outer points of the uncini point in a counter-clockwise direction. Edge of pharynx surrounded by 30 cirri, and scattered over the whole of the oral surface and placed irregularly are numbers of additional small cirri. A distinct non-contractile vacuole is present on the aboral projection, which part of the cytoplasm contains the food-vacuoles. The rest of the cytoplasm is coarsely vacuolated and contains no food-particles of any description. Nucleus extremely large, staining bright reddish-purple with Leishman, and horseshoe-shaped. A distinct karyosome or nucleolus is situated in the nucleus. In 50 % of cases the nucleus appears to be absent (see below).

The organism progresses by means of the aboral cilia, but movement is chiefly effected by a counter-clockwise rotary motion, the oral surface being usually uppermost. Rotation is extremely rapid. When close to foreign bodies the animal creeps over the surface, after the manner of *Euplotes* and *Stylonychia*. For this purpose it utilizes its minute oral-surface cirri. Food in all cases was found to consist of diatoms of the *Navicella* type and ingested Bacteria. Reproduction is by binary fission, one individual retaining the original cytopharynx, the other developing a new one. Division is preceded by complete fragmentation of the nucleus, which seemingly disappears entirely, appearing again in each individual after actual division has taken place. Hence, as mentioned above, a good many of the organisms apparently do not possess a nucleus. This organism, being closely related to *Ichthyophthirius*, may be a factor in the dissemination of disease.

The Infusorian was found later on the gills of *Blennius pholis*, but was absent from *Centronotus gunnellus* and *Gobius ruthensparri*.

The figures of this genus given by Saville-Kent seem totally inadequate as far as illustration goes.

In conclusion, I may state that I have not appended any new names to the parasites from *Cottus* and *Raia*, for the simple reason that there is an enormous amount of confusion centering round the genus *Hæmogregarina*. The procedure of many authors is to give a new name to almost every blood-parasite that they come across, whereas, within certain classes, they are possibly merely dealing with different forms of the same parasite. It seems almost inconceivable that there is a different invertebrate hōst to each genus of fish, and hence it is inconceivable that each genus should be infected with its own particular type of parasite. Variations may be due to the age of the organism, or, what is much more probable, to the different environment in which the organism lives. Until more is known about the life-histories of these forms, it seems superfluous to keep on creating new species, and thus adding to the confusion already existing.

The present work was carried on in the Dove Marine Laboratory, Cullercoats, and I wish to thank Professor Meek and the staff of the laboratory for their kindly help and advice.

I also wish to thank my sister and Mr. P. Gibson for executing the diagrams illustrating this paper.

Sept. 1915.

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EXPLANATION OF THE PLATES.

PLATE XVI.

Fig. 1. *Hæmogregarina cotti.* *1*=curved form in blood-corpuscles of *Cottus.* *2 a* & *2 b*=macrogametocytes from gut of *Calliobdella.* *3 a*=form from spleen of *Cottus.* *3 b*=microgametocyte. *4*=macrogametocyte with discharge of karyosomes. *5 a* & *5 b*=stages in schizogony.

Fig. 2. Dorsal blood-vessel of *Ichthyobdella anarrhichæ*, showing spores

of a Hæmogregarine, × 1500. B=botryoidal tissue; C=coagulated leech-blood; S=spores; W=wall of blood-vessel.
Fig. 3. *Trichodina* sp., × 750. A=acetabulum; D=ingested diatoms; G=lateral groove; N=nucleus.

PLATE XVII.

Fig. 1. Parasites from blood of *Scomber scomber*. *1* & *3* Typical forms in medium lymphocytes. *2* Double infection in lymphocyte. *4* & *7*. Single *Halteridium*-like bodies in erythrocytes. *5* & *6*. Double infection by smaller rounded forms.
Fig 2. *Hæmogregarina* sp from blood of *Raia batis*. *1–4*. Typical examples of the parasite. *5*. A case of double infection.

XLVII.—*On the Lepidoptera collected in* 1913–1914 *by Herr Geyr von Schweppenburg on a Journey to the Hoggar Mountains* (*Sahara*). By LORD ROTHSCHILD, F.R.S., Ph.D.

[Concluded from p. 258.]

PART II.

Geometridæ.

HEMITHEINÆ.

(58) *Hemidromodes affinis*, sp. n.

♂. Allied to *H. robusta* (Prout), but much smaller, and the transverse lines are sharply defined, not merely indicated.

♀. Also smaller than *robusta*, and has two conspicuous transverse white bands on both wings, whereas the ♀ of *robusta* has no markings.

Length of fore wing, ♂, 6 mm.; expanse 14 mm.

" " " ♀, 10 mm., ♀ *robusta*, 16 mm.

1 ♂, 1 ♀, Tahihout, April 28, 1914; 2 ♀ ♀, Amgid, April 22, 1914 (type ♀).

(59) *Hemidromodes subbrunnescens*, Prout.

Hemidromodes subbrunnescens, Prout, Trans. Entom. Soc. Lond. 1915, pt. 3 (Somaliland).

3 ♂ ♂, Rharis, April 15, 1914.

(60) *Acidaliastis micra dissimilis* (Warr.).

Euchloris dissimilis, Warren, Novit. Zool. vol. xii. p 26, pl. iv. fig. 27 (1905) (Nakheila).

1 ♀, Oued Dehin, N. of Idelès, March 20, 1914.

ACIDALIANÆ.

(61) *Ptychopoda transcatenulata*, sp. n.

♂ ♀. Antennæ, head, thorax, and abdomen sandy cinnamon.

Fore wings sandy cinnamon; an antemedian double transverse chain-band black, a black median stigma, and beyond it halfway to apex a black line from costa to vein 6. Hind wing sandy cinnamon, basal ⅖ with patch of black irrorations; a black median stigma, outer ⅗ somewhat clouded with sooty black-grey. Underside whitish buff.

Length of fore wing, ♂ 6 mm., ♀ 8 mm.; expanse, ♂ 14 mm., ♀ 18 mm.

1 ♂, Ti-n-Tabarik, April 14, 1914; 1 ♂, 3 ♀ ♀, Rharis, April 15, 1914 (♀ type); 1 ♂, Tahihout, April 18, 1914.

LARENTIINÆ.

(62) *Pseudosterrha paullula philæaria* (Brab.).

Sterrha philæaria, Brabant, Bull. Soc. Entom. France, vol. lxv. p. 384 1896 (Philæ, Egypt).

1 ♀, Aceksem, April 13, 1914; 2 ♂ ♂, Ti-n-Tabarik, April 14, 1914; 4 ♀ ♀, Rharis, April 16, 1914.

(63) *Lithostege fissurata*, Mab.

Lithostege fissurata, Mabille, Bull. Soc. Entom. France, vol. viii. (ser. 6) p. 58. no. 8 (1888) (Gabès, Tunis).

1 ♂, Oued Abbou, Jan. 17, 1914; 2 ♂ ♂, 1 ♀, Amgid, Feb. 19, 1914.

(64) *Lithostege marmorata*, B.-H.

Lithostege marmorata, Bang-Haas, Iris, vol. xx. p. 83, pl. iii. fig. 15 (1907) (Gafsa, Tunis).

2 ♀ ♀, Amgid, Feb. 19, 1914; 5 ♂ ♂, 1 ♀, Aïn Taïba, May 23–25, 1914.

(65) *Tephroclystia tenellata* (Dietze).

Eupithecia tenellata, Dietze, Iris, vol. xxi. p. 165, pl. ii. figs. 5, 6 (1908) (Gafsa, Tunis).

6 ♂ ♂, 9 ♀ ♀, Amgid, Feb. 20, 1914; 1 ♂, Oued Dehin, March 20, 1914; 1 ♂, 1 ♀, Oued Gif-Aman, March 21, 1914; 1 ♀, Oued Ag'elil, March 18, 1914; 1 ♂, 1 ♀, Timenaiin, March 3, 1914.

GEOMETRINÆ.

(66) *Osteodes latimarginaria*, Rebel.

Osteodes latimarginaria, Rebel, Denkschr. Math.-Nat. Klasse Kais. Akad. Wiss. Wien, vol. lxxi. p. 100 (Lepid. Sud Arab. & Sokotra, p. 70). no. 134 (1907) (Red Sea).

1 ♀, North of Idelès, March 10, 1914; 1 ♂, Oued Tamoudat, March 20, 1914; 1 ♂, Oued Amra, April 4, 1914.

(67) *Tephrina disputaria* (Guen.).

Eubolia (?) *disputaria*, Guenée, Hist. Nat. Ins. Spec. Gén. Lépid. tome x., Uran. et Phal. tome ii. p. 489. no. 1710 (1857) (Egypte).

1 ♂, 2 ♀ ♀, Ti-n-Tabarik, April 14, 1914; 1 ♂, Acekssem, April 14, 1914; 1 ♂, 19 ♀ ♀, Rharis, April 15–16, 1914.

(68) *Tephrina biskraria*, Oberth.

Tephrina biskraria, Oberthur, Etud. Entom. fasc. xii. p. 32, pl. v. fig. 18 (1888) (Biskra).

2 ♂ ♂, Ti-n-Tabarik, April 14, 1914.

(69) *Zamarada secutaria* (Guen.).

Stegania secutaria, Guenée, Hist. Nat. Ins. Spec. Gén. Lépid. tome x., Uran. et Phal. tome ii. p. 45. no. 969 (1857) (Abyssinia).

1 ♀, Ti-n-Tabarik, April 14, 1914; 3 ♂ ♂, 3 ♀ ♀, Rharis, April 15, 1914.

(70) *Zamarada hyalinaria* (Guen.).

Stegania hyalinaria, Guenée, Hist. Nat. Ins. Spec. Gén. Lépid. tome x., Uran. et Phal. tome ii. p. 45. no. 968 (1857) (Abyssinia).

1 ♂, Amgid, Feb. 13, 1914; 1 ♂, Timenaiin, March 3, 1914; 1 ♀, 20 kil. N. of Idelès, March 31, 1914; 1 ♀, Oued Amra, April 4, 1914.

Amatidæ.

(71) *Amata alicia mogadorensis* (Blach.).

Syntomis alicia, var. *mogadorensis*, Blachier, Ann. Soc. Entom. France, vol. lxxvii. p. 219, pl. iv. fig. 9 (1908) (nr. Marakesch).

There is considerable variation among the large series, especially in the gloss, some having the wings with a deep purple gloss, others deep blue, and others again deep green, while there is one ♂ with fore wings glossed with deep green and the hind wings with purple. Some have the subterminal hyaline spot on the hind wing absent. One ♀ has the hyaline spots above veins 3 and 4 on the fore wing as well as the subterminal one on hind wing absent.

11 ♂♂, 3 ♀♀, Oued Ag'elil, March 19, 1914; 17 ♂♂, 9 ♀♀, Idelès, March 30, 1914.

Cossidæ.

(72) *Eremocossus reibellii* (Oberth.).

Hypopta (?) *reibellii*, Oberthur, Etud. Entom. fasc. i. p. 40, pl. iv. fig. 1 (1876) (Biskra).

2 ♀♀, Ti-n-Tabarik, April 14, 1914; 1 ♂ (very large), Amgid, April 22, 1914.

Pyralidæ.

CRAMBINÆ.

(73) *Eromene ocellea* (Haw.).

Palparia ocellea, Haworth, Lepid. Brit. p. 486. no. 21 (1803-1828) (nr. London).

2 ♀♀, Timassinin, Jan. 23 & 26, 1914; 1 ♀, 20 kil. N. of Amgid, Feb. 10, 1914; 4 ♂♂, 2 ♀♀, Amgid, Feb. 13, 1914.

ANERASTIINÆ.

(74) *Polyocha monochromella*, Rag.

Polyocha monochromella, Ragonot, Nouv. Gen. et Esp. Phycit. & Galler. p. 39 (1888) (Shahkuh).

1 ♂, Amgid, Feb. 20, 1914.

(75) *Epidauria strigosa* (Staud.).

Anerastia strigosa, Staudinger, Hor. Soc. Entom. Ross. vol. xv. p. 225 (1879) (Korasdere).

1 ♂, Oued Ag'elil, March 18, 1914.

PHYCITINÆ.

(76) *Nephopteryx geyri*, sp. n.

♀. Antennæ black; head cream-colour; thorax and abdomen brownish cinnamon, a black indefinite patch on first abdominal segment.

Fore wing pale rosy magenta; basal ⅓ saturated with deeper magenta, a broad antemedian band yellowish cream-buff, bordered on each side by a strong black line, outer ⅔ of wing with irregular darker magenta bands and cloudings.

Hind wing dirty white, terminal line fuscous.

Length of fore wing 13·5 mm.; expanse 30 mm.

1 ♀, Ti-n-Tabarik, April 14, 1914.

(77) *Nephopteryx biformis*, sp. n.

The sexes show considerable difference, and there is also much individual variation.

♂. Antennæ brown; head, thorax, and abdomen greyish sandy buff.

Fore wing sandy buff; an oblique antemedian band, broad at costa, narrowing to a point on inner margin, and with a sandy streak in it above median vein; beyond the cell is an arrow-shaped black line, preceded by an almost obsolete tiny smear of brown; a subapical double black streak, from which an obsolescent brown smear runs into wing obliquely; an incomplete postdiscal and a complete terminal row of minute black dots.

Hind wing white, suffused with cream in abdominal area, terminal line brown.

♀. Larger, and suffused on thorax and fore wing with cinnamon wood-grey, and all markings much stronger.

Length of fore wing, ♂ 12 mm., ♀ 14 mm.; expanse, ♂ 27 mm., ♀ 31 mm.

14 ♂♂, 14 ♀♀, Amgid, April 16–20, 1914; 1 ♂, Oued Dehin, March 20, 1914; 1 ♂ (type), Oued Gif-Aman, March 21, 1914.

(78) *Bazania fulvofasciata*, sp. n.

♂. Antennæ whitish above, amber-brown beneath; head and thorax greyish cream-colour, splashed with pale wood-brown; abdomen yellowish cream-grey.

Fore wing greyish cinnamon-cream, with pale wood-brown irregular bands and cloudings; an elongate patch in cell, an oblique antemedian band, and a subterminal band fulvous amber.

Hind wing buffish cream, washed with wood-grey on outer half.

♀. Larger, fore wing more heavily clouded and banded with wood-brown, and the orange-amber bands are darker and wider.

Length of fore wing, ♂ 10, ♀ 11·5 mm.; expanse, ♂ 22·5 mm., ♀ 26 mm.

1 ♂, Amgid, Feb. 16–18, 1914; 1 ♀, Aïn Tahart, Feb. 21, 1914; 1 ♂, Oued Abbou, Jan. 17, 1914; 1 ♀, Oued Tamoudat, March 22, 1914.

(79) *Christophia lactealis*, sp. n.

♂. Antennæ cream-colour; head, thorax, and abdomen pale greyish cream-colour.

Fore wing pale greyish cream-colour, with some irregular scattered black scaling on nervures.

Hind wing pale grey washed with cream, termen darker.

♀. Similar, but paler.

Length of fore wing, ♂ ♀, 11 mm.; expanse 24·5 mm.

1 ♂ (type), Timassinin, Jan. 30, 1914; 1 ♀, Oued Ag'elil, March 18, 1914.

(80) *Christophia datinella*, Rag.

Christophia datinella, Ragonot, Ann. Soc. Entom. France, 1887, p. 233 (Gabès, Tunis).

1 ♂, Amgid, Feb. 16–18, 1914; 1 ♀, Oued Dehin, March 20, 1914. (These two specimens are very pale.)

(81) *Staudingeria fractifasciella*, Rag.

Staudingeria fractifasciella, Ragonot, Bull Soc. Entom France, 1890, p. 111 (Biskra).

2 ♂♂, Timassinin, Jan. 30, 1914; 1 ♂, Amgid, Feb. 16–18, 1914.

(82) *Staudingeria partitella*, Rag.

Staudingeria partitella, Ragonot, Ann. Soc. Entom. France, 1887, p. 249 (Ordubad Sare).

1 ♂, Oued Ag'elil, March 18, 1914; 1 ♂, Oued Dehin, March 20, 1914; 1 ♀, Oued Gif-Aman, March 21, 1914.

(83) *Staudingeria cinnamomella*, sp. n.

♂. Antennæ amber-brown; head white, thorax rosy cinnamon; abdomen, first four segments pale rosy cinnamon, rest of abdomen whitish grey, last segment and anal tuft pale rosy cinnamon.

Fore wing rosy cinnamon; whole costal region to apex and reaching into cell broadly snow-white, narrowing somewhat beyond cell to apex of wing.

Hind wing semivitreous, pale whitish grey, somewhat darker in terminal ⅓ of wing; a terminal cinnamon-grey band.

Length of fore wing 11 mm.; expanse 24 mm.

3 ♂ ♂, Amgid, Feb. 16–18, 1914.

(84) *Staudingeria spatzi*, sp. n.

♂ ♀. Antennæ whitish amber-brown; head and thorax sandy buff; abdomen paler, in some specimens almost white.

Fore wing sandy orange, costal area cream-colour; a postdiscal and a terminal band cream-colour, outer half of wing with some irregular scattered black scaling.

Hind wing satiny pale grey, terminal border sandy orange.

Length of fore wing 10–11 mm.; expanse 22–24 mm.

1 ♂, Timassinin, Jan. 30, 1914; 9 ♂ ♂, 4 ♀ ♀, Amgid, Feb. 16–18, 1914 (type ♀, Amgid); 2 ♀ ♀, Oued Ag'elil, March 18, 1914.

(In some specimens the black scaling has increased so much as to almost obliterate the orange ground-colour; these I propose to call ab. *suffusa*, ab. nov.)

(85) *Staudingeria variabilis*, sp. n.

♂. Antennæ dark brown; head and thorax rufous orange; abdomen paler, more sandy.

Fore wing rufous orange; basal line, costal area to just before apex, an inwardly oblique antemedian band, an outwardly oblique postdiscal band, and terminal area cream-colour; costal area, basal line, and the bands slightly, terminal area densely powdered with black scales; on the disc of the wing near both bands are large patches of black scales somewhat mixed with blue-grey.

Hind wing mouse-grey, darker on terminal line.

Length of fore wing 7 mm.; expanse 15·5 mm.

1 ♂, Amgid, Feb. 19, 1914; 1 ♂, Aïn Tahait, Feb. 21, 1914 (type, Aïn Tahait).

(86) *Staudingeria similis*, sp. n.

♀. Allied to preceding. Antennæ dark brown, with paler rings; head, thorax, and abdomen greyish cream-white dusted with brown.

Fore wing pale cream-colour dusted with brown scales on antemedian and postmedian brown band, joined by three longitudinal lines of brown clouded scaling; subterminal area densely powdered with brown scales, terminal band brown.

Hind wing pale mouse-grey, terminal edge darker.
Length of fore wing 8 mm.; expanse 17·5 mm.
1 ♀, Amgid, Feb. 16–18, 1914.

(87) *Pristarthria brephiella* (Staud.).

Nephopteryx brephiella, Staudinger, Hor. Soc. Entom. Ross. vol. xv. pp. 193, 194 (1879) (Macedonia).

1 ♀, Oued Dehin, March 21, 1914.

(88) *Pristarthria sablonella*, sp. n.

♂. Differs from *brephiella* in the thorax and fore wing being cream-colour, somewhat washed with grey; the antemedian band is more oblique, double, and black, NOT orange, and the submarginal band is further from termen and also black, not orange.

Hind wing cream.
Length of fore wing 11 mm.; expanse 24 mm.
1 ♂, Oued Tamoudat, March 20, 1914.

(89) *Heterographis albicosta* (Staud.).

Myelois albicosta, Staudinger, Berl. Entom. Zeit. vol. xiv p. 202. no. 41 (1870) (Sarepta).

1 ♀, Amgid, Feb. 13, 1914.

(90) *Heterographis sablonella*, sp. n.

♂. Head and thorax clayey buffish sand-colour, abdomen paler.

Fore wing clayey buffish sand-colour.

Hind wings opalescent cream-white; terminal line and fringe pale sandy grey.

Length of fore wing 13·5 mm.; expanse 29 mm.
1 ♂, Oued Abbou, Jan. 16, 1914.

(91) *Syria arenosella* (Staud.).

Anerastia arenosella, Staudinger, Stett. Entom. Zeit. 1859, p. 227. no. 40 (Chiclana).

1 ♀, Feb. 13, 1 ♀, April 22, 1914, Amgid.

PYRALINÆ.

(92) *Aglossa rhodalis*, Hmpsn.

Aglossa rhodalis, Hampson, Ann. & Mag. Nat. Hist. ser. 7, vol. xvii. p. 218 (1906) (Cape Colony).

1 ♂, Idelès, March 10, 1914.

(93) *Actenia geyri*, sp. n.

♂. Antennæ plumose, amber-buff; head, thorax, and abdomen sandy buff.

Fore wing sandy buff; a row of brown streaks in median ⅗ of costa, two dark brown somewhat V-shaped marks below median vein in basal ⅓ of wing, a brown discocellular stigma, some cloudings on disc, and a postdiscal band darker, more orange-buff; on inside of the darker postdiscal band are some irregular dark brown marks on a level with stigma; a terminal line of brown spots.

Hind wing buffy wood-grey, fringe buff.

♀. Similar, but smaller, and wings less developed, and with a duller more greyish wood-buff ground-colour; antennæ serrate.

Length of fore wing, ♂ 15·5 mm., ♀ 12·5 mm.; expanse, ♂ 34 mm., ♀ 28 mm.

1 ♂, Oued Tamoudat, March 22, 1914; 1 ♀, Oued Gif-Aman, March 21, 1914; (♂ type).

(94) *Ulotricha algerialis*, Hmpsn.

Ulotricha algerialis, Hampson, Trans. Entom. Soc. Lond. 1900, p. 377. no. (2), pl. cxi. fig. 18 (Biskra).

1 ♂, 1 ♀, Aïn Taïba, May 23–25, 1914.

(95) *Ulotricha terminalis*, sp. n.

♀. Antennæ brownish maroon; head, thorax, and abdomen brownish maroon.

Fore wing: basal ⅓ brownish maroon, rest cream-white, with a number of pale maroon crossed hair-lines; outer apical ⅓ brownish maroon, sprinkled with cream-white.

Hind wing cream whitish grey, outer ⅔ sprinkled and streaked with pale dirty maroon.

Length of fore wing 11 mm.; expanse 25 mm.

1 ♀, Oued Gif-Aman, March 21, 1914.

(96) *Constantia leonalis* (Oberth.).

Stemmatophora leonalis, Oberthur, Bull. Soc. Entom. France, 1887, p. 76. no. 9 (Biskra).

1 ♂, Oued Ag'elil, March 18, 1914.

Pyraustinæ.

(97) *Nomophila noctuella* (Schiff.).

Pyralis noctuella, Schiffermuller, Syst. Verz. Schmett. Wien, p. 136 (1776) (Vienna).

1 ♂, 50 kil. S. of Ouargla, Dec. 25, 1913; 4 ♂ ♂, 9 ♀ ♀, Amgid, Feb. 16–20, 1914; 1 ♀, Oued Ag'elil, March 18, 1914; 2 ♀ ♀, Oued Dehin, March 20, 1914; 2 ♀ ♀, Rharis, April 15, 1914.

(98) *Cornifrons ulceratalis*, Led.

Cornifrons ulceratalis, Lederer, Wien. Entom. Monatschr. 1858, p. 147, t. iv. fig. 1 (Syria).

1 ♂, 5 ♀ ♀, 25 kil. S. of Bledet Amar, Dec. 16, 1913; 6 ♂ ♂, 3 ♀ ♀, 20 kil. S. of Ouargla, Dec. 23–24, 1913; 3 ♂ ♂, 6 ♀ ♀, 50 kil. S. of Ouargla, Dec. 25, 1913; 8 ♂ ♂, Slassel Dhanoun, Dec. 30, 1913; 2 ♀ ♀, Ghourd Toiba, Dec. 31, 1913; 2 ♂ ♂, N. of Hassi Abbou, Jan. 2 & 3, 1914; 3 ♂ ♂, 7 ♀ ♀, Hassi Abbou, Jan. 13–17, 1914; 6 ♂ ♂, 17 ♀ ♀, Oued Abbou, Jan. 19, 1914; 6 ♂ ♂, 8 ♀ ♀, Timassinin, Jan. 26–30, 1914; 1 ♂, I-n-Kelemet, Feb. 6–8, 1914; 1 ♂, 30 kil. N. of Amgid, Feb. 10, 1914; 8 ♂ ♂, 13 ♀ ♀, Amgid, Feb. 13–20, 1914; 1 ♂, 7 ♀ ♀, Oued Amra, March 15, 1914; 1 ♂, 3 ♀ ♀, Oued Ag'elil, March 19, 1914; 3 ♀ ♀, Oued Dehin, March 20, 1914; 1 ♀, 20 kil. N. of Idelès, March 31, 1914; 1 ♀, Rharis, April 15, 1914.

(99) *Pionea geyri*, sp. n.

♂. Antennæ amber-brown; head, thorax, and abdomen pale sandy buff.

Fore wing white, clouded and banded with irregular bands and cloudings of brownish buff; stigma and terminal row of dots dark brown.

Hind wing cream-white, with rather ill-defined brownish termen, in which is a brown hair-line.

Length of fore wing 8·5 mm.; expanse 19 mm.

1 ♂, Timassinin, Jan. 23, 1914.

(100) *Pionea lactealis*, sp. n.

♂. Antennæ cream-white; head and thorax cream-white; abdomen greyish cream-white.

Fore wing cream-buff with a lemon-yellow suffusion, costal area darkest.

Hind wing satiny brownish cream-white, apical ⅓ washed with grey.

Length of fore wing 10 mm.; expanse 22 mm.

1 ♂, Amgid, Feb. 20, 1914.

(101) *Pionea simplicealis*, sp. n.

♂. Antennæ, head, and thorax rusty wood-brown; abdomen greyish wood-brown.

Fore wing rusty wood-brown; four longitudinal white spots on apical ⅓ of costa, a white spot near base of cell, and a second similar one on discocellulars.

Hind wing satiny wood-grey.

Length of fore wing 11 mm.; expanse 24 mm.

1 ♂, Oued Ag'elil, March 19, 1914.

(102) *Metasia pseudobotys*, Rothsch.

Metasia pseudobotys, Rothschild, Novit. Zool. vol. xx. p. 141. no. 164 (1913) (South Oued Mya).

2 ♂ ♂, Oued Amra, March 14 and April 5, 1914.

(103) *Metasia similalis*, sp. n.

♂. Similar to *pseudobotys*, but larger, duller, and there is a distinct sinuate line beyond middle of hind wing.

Antennæ, head, thorax, and abdomen greyish sandy buff.

Fore wing greyish sandy buff, NOT rufous buff as in *pseudobotys*; an ante- and a postmedian sinuate black band and two black ring-like stigmas in cell.

Hind wing satiny buffish wood-grey, with sinuate postmedian shadow-bands.

Length of fore wing, ♂ *pseudobotys* 8 mm., ♂ *similalis* 10·5 mm.; expanse, *pseudobotys* 17·5 mm., *similalis* 23 mm.

2 ♂ ♂, Rharis, April 15, 1914.

(104) *Noctuelia desertalis* (Hübn.).

Pyralis desertalis, Hübner, Samml. Europ. Schmett., Pyr. fig. 171 (1793–1827) (Europe).

1 ♀, Tahihout, April 28, 1914.

All the specimens enumerated in both parts of this article are in the Tring Museum.

XLVIII.—*Description of a new Tree-frog of the Genus* Hyla *discovered by Mr. A. E. Pratt in the Arfak Mountains, Dutch New Guinea.* By G. A. Boulenger, F.R.S.

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[Plate XVIII.]

Hyla angiana.

Tongue circular, free, and slightly notched behind. Vomerine teeth in two oblique series between the choanæ or on a level with the hinder edge of the latter. Head rather strongly depressed, as long as broad or a little broader than long; snout rounded; canthus rostralis distinct; loreal region feebly concave; eye as long as or a little shorter than the snout; interorbital space broader than the upper eyelid; tympanum very distinct, small, one-third to two-fifths the diameter of the eye. Fingers one-third webbed; no projecting rudiment of pollex; toes webbed to the disks; subarticular tubercles well developed; disks large. The hind limb being carried forwards along the body, the tibio-tarsal articulation reaches the eye or the tip of the snout; tibia a little more or a little less than half the length from snout to vent. Skin smooth above, granular beneath, areolate on the sides; a strong fold above the ear, but no parotoids. Slate-blue above (in spirit), the sides of the body and the outer side of the head, foot, and tarsus sometimes crimson, with white spots or marblings; a white streak on the upper lip, at least from below the eye; a white streak, or white spots, on the lower lip; a white streak above the vent, another along the inner side of the leg and the outer side of the tarsus; throat blue or purple, belly white. Male without ossified omosternum, with an external gular vocal sac, and a patch of fine dark brown rugosities on the inner side of the basal part of the inner finger.

	♂. mm.	♀. mm.
From snout to vent	57	85
Head	18	24
Width of head	18	26
Snout	7	8
Eye	6	8
Tympanum	2	3
Fore limb	33	50
Hand	18	25
Disk of third finger	4	5
Hind limb	89	130
Tibia	28	41
Foot	24	33

Four specimens (2 ♂, 2 ♀) from the Angi Lakes (6000 feet) in the Arfak Mountains. A fifth specimen (♀) from Mount Koebré (8000 feet) in the same mountains. Presented to the British Museum by the collector, Mr. A. E. Pratt.

This frog belongs to the group of *Hyla cærulea*, with which I have recently dealt*. In the male secondary sexual characters it agrees with *Hyla cærulea*, but differs in the small tympanum, a character which it shares with *H. humeralis*.

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* Zool. Jahrb., Suppl. xv. 1, 1912, p. 211.

EXPLANATION OF PLATE XVIII.

Hyla angiana, ♀, natural size, with lateral view of head and anterior part of body, and open mouth.

XLIX.—*New Genera and Species of Mammals from the Miocene Deposits of Baluchistan.—Preliminary Notice.*

By C. Forster-Cooper, M.A., Superintendent, University Museum of Zoology, Cambridge.

The following specimens were obtained from the Dera Bugti province of Baluchistan; the types and other specimens will be placed, together with the rest of the collection, in the British Museum of Natural History, as soon as the whole collection is catalogued.

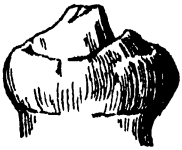
Parabrachyodus obtusus, gen. nov.

In a previous issue of this Journal (vol. xii., December 1913, p. 520) I described a third lower molar as that of a new species doubtfully referred to the genus *Brachyodus*. Some fragments of maxillæ seem to agree with this particular tooth as regards size and general characteristics, and, as they show a peculiarity which distinguishes them from the genus *Brachyodus*, a new genus is here created for them.

The type-specimen of the genus is a left maxilla showing the fourth premolar and the full series of three molars (fig. 1). Like the lower molar (fig. 2) already described (*loc. cit.*), the teeth are brachyodont and bunodont, with a moderately well-marked cingulum, and are not easily to be distinguished from those of *B. giganteus*, the third upper molar being extremely like the cast of the type third molar of the latter species. The fourth premolar, however, shows a distinct difference, in that the upper cusp is practically aborted and shows as a very thin ridge lying just inside the well-developed inner cingulum. A side-view (fig. 1 A) is here given, showing the difference between the outer cusp, which is normal in size and somewhat worn, and the inner cusp, which, though quite untouched by wear, is very small.

That the condition is not an individual variation is shown by its occurrence in more than one specimen. It is possible that Lydekker's *B. giganteus* belonged to a similar form, in which case some help would be given in elucidating the very complex *giganteus-hyopotamoides* series found in this locality.

Fig 1 A.



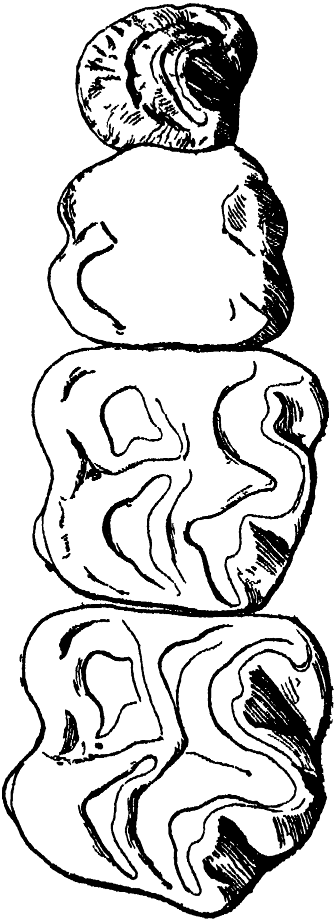
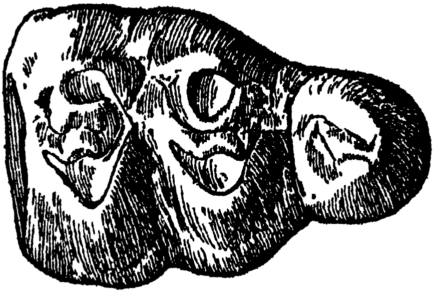


Fig. 1.

For the present, however, the question must remain in abeyance, since the type-specimen of *B. giganteus* is a single molar.

Fig. 2.



The characters of this genus, so far as can be ascertained at present, are:—

1. Fourth upper premolar with the inner cusp much reduced.
2. Third lower molar much wider in front than behind.
3. The teeth generally are very brachybunodont (a character shared, of course, with other Anthracotheroid genera).

Measurements:—

	Length. mm.	Breadth. mm.
PM⁴..................	15·0	21·8
M¹	28·0	31·0
M²	35·3	30 0
M³	39·0	43 8

Gelocus indicus, sp. n. (Fig. 3.)

The Traguloids thus far discovered in the Indian region are *Tragulus sivalensis* (Lyd.), *Dorcatherium minus* (Lyd.), *D. majus* (Lyd.), *Prodremotherium beatrix* (Pilg.), and *Gelocus gajensis* (Pilg.).

Of these forms *Tragulus sivalensis* is certainly represented in the present collection; *Gelocus gajensis* and *Prodremotherium beatrix* probably occur also, but the specimens are not as yet fully determined. Among them, however, is an upper molar showing characters sufficiently distinct to warrant its description as a new species.

The genus *Gelocus* has never properly been described; it was founded by Aymard on the species *Amphitragulus com-*

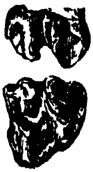
munis (Cong. Sci. Franç. 1885), the generic name *Amphitragulus* being changed to *Gelocus* without comment or diagnosis.

The present specimen, a third upper molar, therefore is placed provisionally in this genus, relying on the characters given by Lydekker as follows:—

"The upper molars of this genus have extremely low columns with wide open valleys; the external surface of the hinder lobe of each of the outer columns is markedly concave," &c. (Cat. Foss. Mamm.).

This tooth shows all these characters and in general plan is similar to a corresponding tooth of *Gelocus communis* in the British Museum collection (m. 27596) *.

Fig. 3.



The specific differences from it of the present specimen are:—

1. A greater concavity of the external face of the metacone. The posterior horn of the cusp runs down to the cingulum and then turns forward as a sharp ridge to join the mesostyle, which turns back to meet it at the middle of the cusp, the two forming a "cingulum" ridge with a noticeable ditch between it and the body of the cusp.
2. The posterior horn of the protocone does not abut against the metaconule (hypocone, according to some authors), but turns sharply forwards, leaving a deep groove between the two internal cusps.
3. The cingulum is well marked only at the front border of the protocone and in the valley at its posterior edge, *i. e.* between the two internal cusps. In *G. communis* it is continuous round the cusp.
4. The tooth is larger than that of *G. communis* and too small for Pilgrim's specimen (a lower molar) of *G. gajensis.*

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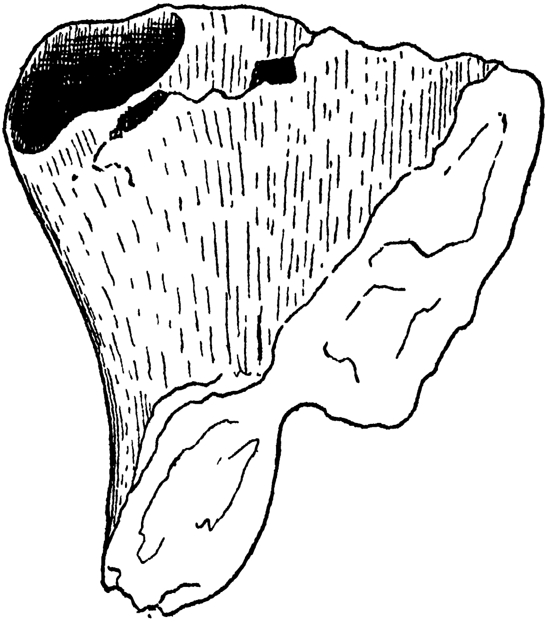
* This specimen, by an error, is catalogued as a lower jaw. It is an upper jaw.

Aprotodon smith-woodwardi, gen. et sp. n.

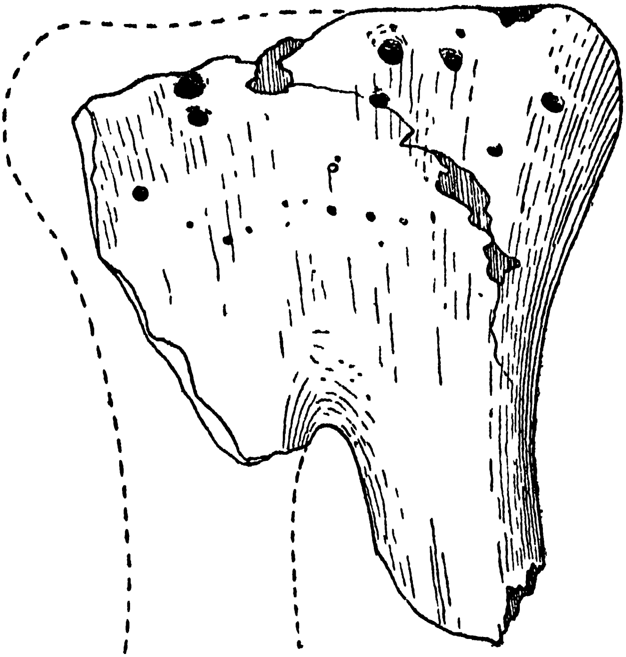
Two fragments of mandibular symphysis, of one of which the upper and lower sides are figured (figs. 4 & 5), and a portion of the orbital region of a skull are undoubtedly parts of a small hippopotamus. These are interesting as the earliest-known occurrence of the hippopotamus (considerably before the genus *Merycopotamus*, which has been suggested as close to the ancestral line). The skull portion is indistinguishable from that of the Hippopotamidæ in general, and is about the size of *H. lemerlei*. The lower jaws, so far as the fragments go, also show a general similarity to those of the family, but differ in the apparent absence of incisor teeth. Both fragments are the same in this respect, the front border being very thin, and where it is broken away in places there is no sign of tooth-sockets. This might be due to closure of the socket from extreme old age, but there is nothing to show that this was the case. One of the fragments shows the stump of the first premolar. Large canines were present, as shown by the sockets.

Fig. 4.



Width across the jaw from the outside of the canines (estimate, the measurement taken to the middle line and doubled) 20 cm.; depth of symphysis 11 cm.; width of ramus behind symphysis 5·5 cm.

Fig. 5.



Note on the Dentition of Hemimastodon crepusculi (*Pilg.*).

Pilgrim * has described some Proboscidian teeth from this locality as belonging to *Hemimastodon*, a new genus intermediate between the genera *Palæomastodon* and *Tetrabelodon*. In the present collection are two palates and corresponding portions of lower jaws of young adult individuals, which, being fairly complete except for the symphysial region, throw some additional light on the dentition of this genus. The palates show two three-ridged teeth—the first and second molars—with remains of two smaller two-ridged teeth in front, which apparently represent the third and fourth premolars.

Pilgrim figures † the last two milk-teeth of this species, and the last milk-tooth in his specimen being much smaller and otherwise different from the first three-ridged tooth in mine shows that the latter is a true molar, and the teeth in front of it are true premolars and not milk-teeth.

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* Pilgrim, 'Palæontologia Indica,' n. s., vol. iv. memoir 2.

† Pilgrim, *loc. cit.* pl. iv. fig. 9.

The lower-jaw fragments show in one specimen the last premolar and the three molars, the last molar being in the alveolus, fully formed and ready to come into wear; it is formed at a slanting angle to the future plane of wear, as in all later Proboscidia. The other specimen shows only the last premolar and the first two molars.

Pilgrim[*] has suggested that the teeth described by Lydekker[†] from this locality as *Tetrabelodon angustidens*, var. *palæindicus*, really belong to *Hemimastodon*. That this surmise is correct is proved by the fact that the third lower molar of the first jaw mentioned above is the same as the tooth figured by Lydekker[‡] as belonging to the variety of *T. angustidens*.

The dentition of the genus therefore is :—

$$\begin{array}{cccc} \text{I.} & \text{C.} & \text{PM.} & \text{M.} \\ \frac{0.2?.0}{0.2?.0} & \frac{0}{0} & \frac{0?.0?.3.4}{0?.0?.3.4} & \frac{1.2.3}{1.2.3}. \end{array}$$

The shape of the symphysis is at present unknown, and whether the anterior premolars were present or not cannot be determined from these specimens. From the condition in *Palæomastodon* it is reasonably certain that they were absent. In *Palæomastodon* all upper teeth from the second premolar to the last molar and all lower teeth from the third premolar onwards are in wear at once. In *Hemimastodon* the third and fourth premolars above and below are much worn, and are probably pushed out before the third molar is erupted, leaving the three molars in wear. In *Tetrabelodon*[§] the second and third premolars are cut in both jaws, but are entirely lost before the second molar comes into wear. In all later forms the premolar series is entirely suppressed. *Hemimastodon*, therefore, is shown to occupy a place halfway between the genera *Palæomastodon* and *Tetrabelodon*, and, considering its probable horizon, this is what we should expect.

A further description and figures of these interesting fragments will be published in a forthcoming catalogue of the whole collection from the Bugti region.

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[*] Pal Ind n. s. vol. iv. memoir 2.

[†] Pal. Ind. (10) vol. iii. pl. iv. fig. 3.

[‡] Trans. Roy. Soc. B. vol. 199, pp. 393-407.

[§] Trans Roy. Soc. B. vol. 196, pp. 99-118.

L.—*Descriptions of Three new Neotropical Butterflies.*
By Emily M. Bowdler Sharpe.

Having been entrusted by the late Captain Harry S. Toppin, who was employed by the Government on the Peru-Bolivian Boundary Commission, to work out the collection of insects made by him, I have found three species of butterflies which appear to be new. These are described in the present paper. One species of Hymenoptera, also new, has very kindly been described for me by Mr. Rowland E. Turner.

A full list of the species collected will appear as an appendix shortly, with an account of the journey made by Captain Toppin, published in a book by the Royal Geographical Society.

Unfortunately for science, Captain Toppin lost his life at the battle of the Aisne, on the 14th of September, 1914. He had previously arranged that all types and any other species required for the National Collection should be presented to the Natural History Museum.

The collection has been carefully collected and is in beautiful condition; the remainder is to be kept in his family, where it will be greatly prized.

Family Nymphalidæ.

Pyrrhogyra toppini, E. M. Sharpe, sp. n.

Closely allied to *Pyrrhogyra amphira*, Bates, of which it may possibly be only a local form, and from which it differs as follows:—The white patch in the centre of the fore wing narrower, the white spot at the end of the discoidal cell smaller, followed by a distinct white spot on the apical area; a suffusion of light spots on the hind-marginal border.

On the hind wing the white patch is also narrower, with a suffusion of light spots on the dark brown hind-marginal border; the red spot on the anal angle is entirely absent.

Underside very similar to that of *P. amphira*.

Expanse 2¼ inches.

Three specimens collected. The type has been presented to the Museum.

Family **Erycinidæ.**

Euselasia toppini, E. M. Sharpe, sp. n.

Allied to *Euselasia eucritus*, Hewits., but distinguished by having the basal area of the fore wing purple, and the same colour on the marginal border of the hind wing as in *Eurygona gelànor*, Cram.; general colour dark brown.

The underside is very distinct, having alternate transverse lines of brown and white, with bright orange at the base and on the hind-marginal border of the fore wing. The hind wing is heavily marked with similar transverse lines. The orange patch at the base of the wing relieved by a black spot. On the anal angle the lines are nearly black, with fine lines of white and orange, and near the submedian nervure is a black streak.

Expanse $1\frac{1}{8}$ inch.

One specimen only was collected.

Type in the Natural History Museum.

Family **Pieridæ.**

Catasticta toppini, E. M. Sharpe, sp. n.

This handsome and distinct species is similar to *Catasticta tricolor*, Butl., but has the band on the fore wing flame-colour, a spot of the same colour being visible near the end of the discoidal cell; a row of rather minute yellow spots are visible on the brown hind-marginal border, also a small streak of yellow on the inner margin.

On the hind wing the flame-coloured spots form nearly a band crossing the discal area, and the hastate spots on the hind-marginal border are yellow instead of red as in *C. tricolor*, a second row of minute yellow spots being visible on the extreme edge of the wing.

The underside hardly differs from the allied species, with the exception of the flame-coloured spots being very distinctly developed on the fore wing.

Expanse $2\frac{1}{12}$ inches.

Only the one specimen was obtained.

Type in Natural History Museum.

HYMENOPTERA. By ROWLAND E. TURNER.

Family **Psammocharidæ.**

Subfamily *PEPSINÆ.*

Pepsis toppini, R. E. Turner, sp. n.

Nigra, sparse nigro-pilosa; flagello aurantiaco, articulo primo, secundoque dimidio basali nigris; alis pallide flavis, venis ferrugineis.

Long. 52 mm.

Clypeus broadly and shallowly emarginate at the apex. Second joint of the flagellum about five times as long as thick; third more than two-and-a-half times as long as thick. Eyes separated on the vertex by a distance equal to the length of the second joint of the flagellum; a strong transverse ridge on the vertex behind the ocellar space. Pronotum broadly rounded at the anterior angles; mesonotum with a low median carina on the posterior half. Median segment coarsely transversely striated, rather thickly covered with long black hairs, convex in the middle, the carina separating the horizontal and vertical portions indistinct except in the middle, the lateral basal tubercles well developed but blunt, the tubercles at the apical angles of the horizontal area strongly developed, the horizontal area nearly as long as the width at the base. Abdomen elongate-ovate. Tarsal ungues nearly as long as the third joint of the hind tarsi, inner spur of the hind tibiæ about one-quarter of the length of the basal joint of the hind tarsi. Radial margin of the third cubital cell more than half as long again as the second transverse cubital nervure.

Hab. Peru-Bolivian boundary, between lat. 11° 30′ S. and 14° 15′ S., long. 69° to 69° 30′ W.; May–November (*Capt. H. S. Toppin*).

This is very near the Mexican *Pepsis optima*, Sm., but differs in the greater distance between the eyes, the more strongly developed ridge on the vertex, the greater development of the tubercles of the median segment, the longer radial margin of the third cubital cell, and the shorter tarsal ungues. There are five long setæ at the base of the hind tarsal ungues in *optima* and four in *toppini*.

The species is named after its discoverer, Captain Toppin, who fell in the battle of the Aisne.

Presented to the British Museum.

LI.—*Two new Species of* Monhystera *(Nematodes) inhabiting the Gill-chambers of Land-crabs*[*]. By H. A. Baylis, B.A.

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Dr. Charles B. Wilson, of Westfield, Mass., has kindly submitted to me for examination some small worms which were found by him in the gill-chambers of land-crabs in Jamaica during July 1910. They prove to be minute Nematodes belonging, apparently, to the free-living genus *Monhystera*, Bastian. They are of two species, and came from two species of crabs, determined by Dr. Wilson as *Gecarcinus ruricola* and *Cardisoma guanhumi*. Of these species, the former provided examples of both Nematodes, the latter only of one.

The chief points of interest to be noted with regard to these "parasites" (the word is here used in a broad sense) are: (1) that they belong to a genus the species of which are commonly found leading a free existence in the earth or in fresh water, and are not known to have a parasitic phase; (2) that both the forms, as found in the crabs, appear to be either hermaphrodite or parthenogenetic, and at first sight seem to be all females; and (3) that they are evidently not specially adapted for a "parasitic" mode of life, inasmuch as the number of young produced by one female is comparatively small, and these young are apparently hatched from the egg before birth.

In order to facilitate the description of the new species, I shall employ certain formulæ for expressing the relative lengths of various parts of the body. For this purpose I prefer the system of de Man[†] to that of Cobb[‡], as being simpler and requiring less mathematical calculation[§].

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[*] Other notes on the fauna of the gill-chambers of the Gecarcinidæ will be found in the following papers:—Wilson, C. B., "Crustacean Parasites of West Indian Fishes and Land Crabs," Proc. U.S. Nat. Mus. vol. xliv. p. 189 (1913). Baylis, H. A., "Oligochæta" in Brit. Antarctic ('Terra Nova') Exp., 1910, Zoology, vol. ii. no. 2, p. 13 (Brit. Mus., 1915); and "A Parasitic Oligochæte, &c.," Ann. & Mag. Nat. Hist. (8) xv. p. 378 (1915).

[†] 'Die frei lebenden Nematoden der Niederländischen Fauna,' 1884.

[‡] "Arabian Nematodes," Proc. Linn. Soc. N.S.W. (2) v. 1890, p. 449.

[§] In adopting de Man's system, I follow the example of some other writers on free-living Nematodes *e. g.* Hofmänner and Menzel in various recent memoirs on the group (Rev. Suisse Zool. xxiii. no. 5, 1915, and other papers).

According to de Man's system, the symbol $\alpha = \frac{\text{total length}}{\text{thickness}}$, $\beta = \frac{\text{total length}}{\text{length of œsophagus}}$, and $\gamma = \frac{\text{total length}}{\text{length of tail}}$. To these symbols I shall, for the purposes of the present paper, add a fourth, δ, to signify $\frac{\text{total length}}{\text{distance between anus and vulva}}$. This can be applied, of course, only to female and perhaps, in some cases, to hermaphrodite individuals, but is useful in the present instance as a specific character.

It should be noted that in the following descriptions the length of the œsophagus is taken to include the posterior sucking-bulb.

1. *Monhystera wilsoni*, sp. n. (Figs. 1–3.)

Measurements taken from a detailed examination of eight specimens :—

♀. Length 1·4–1·6 mm. Thickness very variable, especially in the region of the head and neck.

$\alpha = 19–32{\cdot}5$.
$\beta = 5{\cdot}7–8$ (usually about 7).
$\gamma = 8{\cdot}4–10{\cdot}7$.
$\delta = 4–4{\cdot}7$.

♂ unknown.

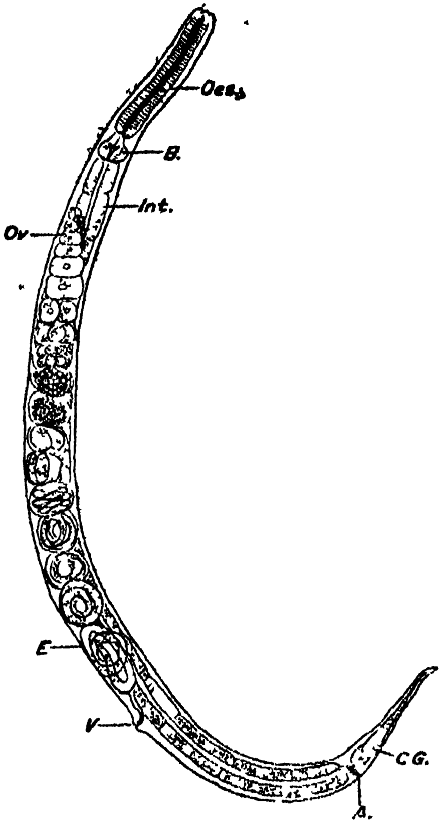
Hab. Gill-chambers of *Gecarcinus ruricola.*

The cuticle of this species is generally marked with fine longitudinal striations, but there are no transverse markings. The head is sometimes very broad and square, sometimes more tapering. The tail tapers rather rapidly from the anus for about half its length; the posterior half is more cylindrical, narrowing abruptly near the tip, and ending in a small conical papilla ("spinneret" or adhesive organ).

No lateral organs are visible in the usual position near the head-end. The lateral fields are about one-fifth as wide as the body.

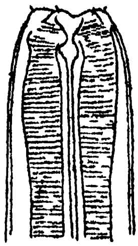
The mouth (fig. 2) is small, and is surrounded by six slight cuticular elevations, two of which are dorsal, two ventral, and two lateral. Each bears a minute setose papilla. The mouth-cavity is small and shaped somewhat like a "thistle funnel." The œsophagus is at first of the ordinary cylindrical type, with thick walls and narrow lumen. At its posterior end, as in *M. bulbifera*, de Man, there is a pear-shaped sucking-bulb (fig. 3, *B.*), marked off from the rest of the œsophagus by a constriction, and similarly distinct from

Fig. 1.



Monhystera wilsoni, mature ♀. Lateral view, much magnified
A, anus, *B.*, bulb of œsophagus; *C G*, caudal glands, *E.*, embryo free in uterus, *Int*, chyle-intestine, *Oes*, œsophagus, *Ov.*, ovary; *V*, vulva.

Fig. 2.

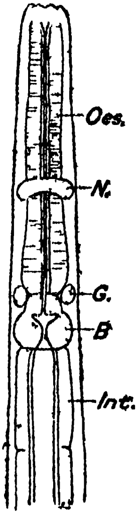


Monhystera wilsoni: head-end, very highly magnified, seen from the ventral side.

the intestine, which follows it. The narrow portion of the bulb is anterior. At the sides of the anterior neck of the bulb there are two large spherical or ovoid cells, with granular contents, and perhaps of glandular nature (fig. 3, *G*). The walls of the chyle-intestine are composed of a single layer of large oblong cells filled with rather dark brown granules, and lined with the usual cuticular layer.

The vulva (fig. 1, *V.*) is situated at about the beginning of the last third of the body. The ovary is unpaired, and composed of a single row of ovarian cells. Its apparent

Fig 3



Monhystera wilsoni: anterior end, showing *B.*, bulb of œsophagus, *G*, gland-cells (?) at sides of the bulb, *Int*, chylo-intestine; *N.*, nerve-ring, *Oes*, œsophagus.

commencement is shortly behind the bulb of the œsophagus, but in reality its anterior end is bent back upon itself for a short distance. In the uterus a single row of large ova can be seen (fig. 1), generally in all stages of development, from unsegmented eggs at the anterior end to fully-developed embryos at the posterior end. Sometimes there is one egg in each stage of segmentation, so that the complete developmental history can be seen by simply following along the uterus from one egg to the next. The last 3–5 eggs generally consist of fully-formed embryos still enclosed in their membranes; occasionally, however (fig. 1, *E.*), one or two embryos appear to be already free *in utero*, and it may be inferred that the species is viviparous.

There are two large caudal gland-cells (fig. 1, *C.G.*), situated, one behind the other, just behind the anus, and with long fine ducts passing to the adhesive organ at the tip of the tail.

Among about 100 examples of this species more or less closely examined, not a single male was observed, and I did not notice any individuals which appeared to be hermaphrodite. Hence it seems probable that this species is capable of multiplying parthenogenetically, or at least that the form found in the crab represents a parthenogenetic generation. It is, of course, possible that there is also a free-living bisexual generation.

2. *Monhystera carcinicola*, sp. n. (Figs. 4–6.)

Mature ♀. Length 1·1–1·6 mm. (usually 1·1–1·2 mm.).

$\alpha = 21\text{–}32{\cdot}7.$
$\beta = 5{\cdot}7\text{–}7{\cdot}2$ (usually 6–6·2).
$\gamma = 10{\cdot}5\text{–}13{\cdot}3.$
$\delta = 8\text{–}12{\cdot}6.$

☿. Length 1·1–1·2 mm.

$\alpha = 24\text{–}26{\cdot}6.$
$\beta = 5{\cdot}5\text{–}6.$
$\gamma = 11{\cdot}5\text{–}13.$

Hab. Gill-chambers of *Gecarcinus ruricola* and *Cardisoma guanhumi.*

The first set of measurements given above were taken from ten specimens containing more or less mature female organs, while the second set are based upon the only two specimens which showed distinct hermaphroditism. Of the twelve specimens of this species available, eight came from *Gecarcinus ruricola,* and the remaining four from *Cardisoma guanhumi.* One hermaphrodite specimen occurred in each host. No important differences were noticed between the two sets, but those from *G. ruricola* were in somewhat better condition, and for this reason my description will be mainly based upon them.

This species is, as a rule, distinctly smaller and more slender than *M. wilsoni,* but at a glance it is not very easy to separate the two. In most respects the anatomy is very similar, but the following are important points of distinction. The head-end (fig. 5) is always slender and somewhat tapering; it is never blunt and square like that of some individuals of the former species. A pair of lateral

Fig. 4.

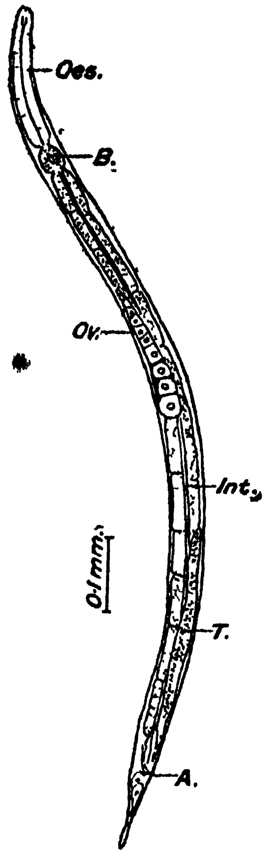


Fig. 5.

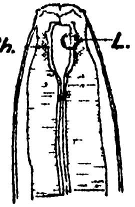


Fig. 6.

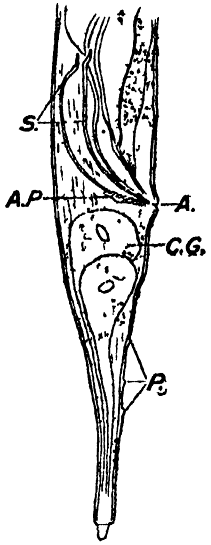


Fig. 4.—*Monhystera carcinicola*: hermaphrodite form from *Cardisoma guanhumi*. Lateral view, much magnified.
A., anus; *B.*, bulb of œsophagus; *Int.*, chyle-intestine; *Oes.*, œsophagus; *Ov.*, ovary; *T.*, testis.

Fig. 5.—*Monhystera carcinicola*: head-end, very highly magnified. *Ch.*, chitinous rod in wall of mouth-cavity; *L.*, lateral organ.

Fig. 6.—*Monhystera carcinicola*: tail-end of hermaphrodite form from *Cardisoma guanhumi*, highly magnified.
A., anus; *A.P.*, accessory piece; *C.G.*, caudal glands; *P.*, papillæ; *S.*, spicules.

organs (fig. 5, *L.*) is always distinctly visible close to the head-end; they are small and of circular form.

The mouth is minute, and is surrounded, as in the other case, by six exceedingly slight cuticular elevations, each bearing a very small papilla. The papillæ, however, are not setose, but conical. The mouth-cavity is much larger in this species, and is of oblong shape. Its walls are strengthened by four longitudinal chitinous rods of peculiar shape (fig. 5, *Ch.*).

The bulb of the œsophagus (fig. 4, *B.*) is smaller, and of a somewhat different shape from that of *M. wilsoni*. It is more oblong than pyriform, and nearly parallel-sided, except at its anterior end, which is conical. A pair of large granular cells is present at the sides of the bulb, near its junction with the œsophagus, as was observed to be the case in the preceding species. The granules contained in the large cells of the chyle-intestine are of a paler colour than in *M. wilsoni*, this character affording one of the readiest means of distinguishing the species.

In the female the vulva is situated much nearer to the anus, as is shown at a glance by the values given for δ at the beginning of the descriptions. The distance between anus and vulva is, in fact, almost equal to the length of the tail. The number of eggs usually found in the uterus in mature forms is much greater than in *M. wilsoni*. There may be from 16 to 20, and their development, though apparently more gradual, appears to take place more simultaneously, a considerable number of embryos being at about the same stage, instead of developing one at a time.

Finally, all the embryos appear to rupture their egg-membranes, and lie stretched out nearly straight within the uterus. This condition was never observed in *M. wilsoni*. It is possible that they do not escape until the death or rupture of the parent.

Two examples, having mouth-parts and most of the other organs precisely similar to those of the females, were found to contain both male and female reproductive organs (fig. 4). In both cases there were spicules and an ovary, and there also appeared to be a functional testis; but in neither were any fertilized ova seen, nor was there any trace of a vulva. It seems probable that the species is a protandrous hermaphrodite, the same individual which functions at first as a male subsequently losing its spicules and other evidences of male nature, and becoming purely female. Presumably a vulva is developed at this period, and the worm becomes capable of being impregnated by another individual.

In the hermaphrodite examples there appear to be two excessively fine spicules and a chitinous accessory piece (fig. 6, *S.*, *A.P.*). There are also three pairs of minute postanal papillæ (*P.*).

I have placed this species in the same genus as the first-described form, in spite of the peculiar structure of the mouth-cavity, because in most respects the two are so closely similar that I do not feel justified in separating them generically.

LII.—*A Note on the Parasphenoid of a Palæoniscoid.* By HENRY DAY, M.Sc., Geological Department, The University, Manchester.

WHILST engaged in the determination of a number of fish-remains collected by the late Mr. Binney of Manchester, and labelled merely as "fish-remains," I came across two excellent examples of the bone which has been called "parasphenoid" by Traquair (1) speaking of *Gonatodus*, and similarly by Fritsch (2) for *Trissolepis*, *Sceletophorus*, *Amblypterus*, and *Acrolepis*. This particular bone of the fish cranium is very rarely found, however, in any very complete state of preservation; in fact, the one found by Traquair in *Gonatodus*, and described and figured by him (1, p. 16, pl. ii. fig. 5), was the only one he encountered in his work on the Palæoniscidæ.

Traquair's example is apparently only moderately well preserved, although he speaks of it as "a well-developed parasphenoid," but Fritsch was more fortunate in finding good examples in association with determinable fish-remains.

In addition to the above two specimens from the Pendleton Colliery, in the Binney collection, a third specimen came to light in association with other fish-remains, from Ashton Moss Colliery, and obviously incorrectly determined as "*Acanthodes*."

It is now proposed to describe these specimens in some detail since they exhibit several very interesting features, which throw light on the homology of this element.

All three specimens agree in general form and size with Traquair's figured example, and would therefore in all probability have belonged to fishes of about four or five inches in length.

Actual specific determination is difficult, but two of the specimens are associated with other remains. One of the Pendleton examples is associated with typical Palæoniscoid scales, and the example from Ashton Moss Colliery is associated with the disarticulated skull-bones of a Palæoniscoid fish, in association with scales which can be generically identified as those of *Rhadinichthys*—probably *R. monensis*, judging by the scale ornament. The second Pendleton example exactly resembles the Ashton one, and probably belongs to the same, or closely allied species. The three specimens combined give an excellent idea of both dorsal and ventral views of the bone.

For convenience they will be described under the letters A, B, and C. A gives us a dorsal view of the bone; B is in part a ventral view, but anteriorly is merely cast; and C is an almost perfect cast of the dorsal surface, and supplements the facts observed in A.

The bone consists essentially of a posterior rounded expanded portion and an anterior rostrum or shaft. The posterior portion possesses two pairs of lateral processes or wings—an anterior pair situated at the junction of the shaft and posterior expansion, and a posterior pair from the postero-lateral margins of the expansion.

Dorsal View. (Specimen A.)

In the greater part of specimen A the actual bony material is preserved, and an excellent view is given of the main features of the dorsal surface.

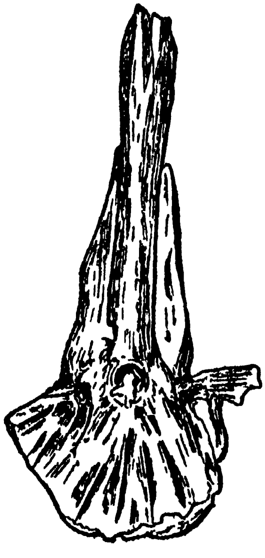
Anteriorly there is the long shaft which presents a rounded convex surface to the observer (*i. e.*, is dorsally convex). It is constricted behind and expands anteriorly to give a slightly club-shaped anterior extremity. The actual anterior extremity in all three specimens exhibits distinct evidence of having been forked, resembling in this respect the compound para-basisphenoid of the common snake and the parasphenoid of certain living and extinct Amphibia.

The shaft, for its posterior two-thirds, is bounded by a pair of wings closely applied to it. These wings are broad behind, and, gradually tapering anteriorly, pass into the shaft about one-third from its anterior extremity. Posteriorly they pass into the broadened posterior part of the bone at the point where the anterior pair of processes come off. These wings, the bony material of which is actually preserved, each present a concavity to the observer (*i. e.*, dorsally concave); hence in specimens B and C, in which the shaft and side-wings are represented as casts, we have the shaft represented (except for adherent fragments of bone) as a concavity to the observer, whilst the side-wings stand out as convexities.

Coming now to the posterior expanded part of the bone, we find on the centre line of the specimen, and immediately behind the posterior termination of the shaft and wings, a distinct, rounded, slightly oval depression, which is marked out by a definite raised rim, broken in part by splintering of the bone. This pituitary region—depression and rim—is even better marked out in the cast C of this dorsal surface.

By the side of the pituitary depression we have the right anterior lateral process preserved, passing outwards and very slightly forwards. This process is apparently of the nature of a thick flange of bone, constricted near the base, rounded off at its outer and rather wider extremity, and bearing on its dorsal surface two or three well-defined ridges. The corresponding process of the left side is cut off by the broken edge of the rock, whilst the posterior pair of processes is also missing.

Fig. 1.



Dorsal view of the compound para-basisphenoid bone of *Rhadinichthys monensis.* (Specimen A.) × 7·6 diams. No. L 10820. M. M.

A broad well defined ridge runs outwards and backwards on each side from the region of the pituitary depression, and the whole of the expanded region of the bone posterior to these ridges and the pituitary depression has the form of a shallow basin-shaped hollow, with a circular outline posteriorly. The whole of this basin is floored by the actual bony material, but for a few splinters flaked off on the posterior margin. The surface of this hollow is almost smooth, only a few faint radiating ridges and grooves being visible.

Immediately anterior to the broad ridge on each side, mentioned above, there is a shallow depression, followed anteriorly by a slight prominence. These appear as reversed features on specimen C.

Ventral View. (Specimen B.)

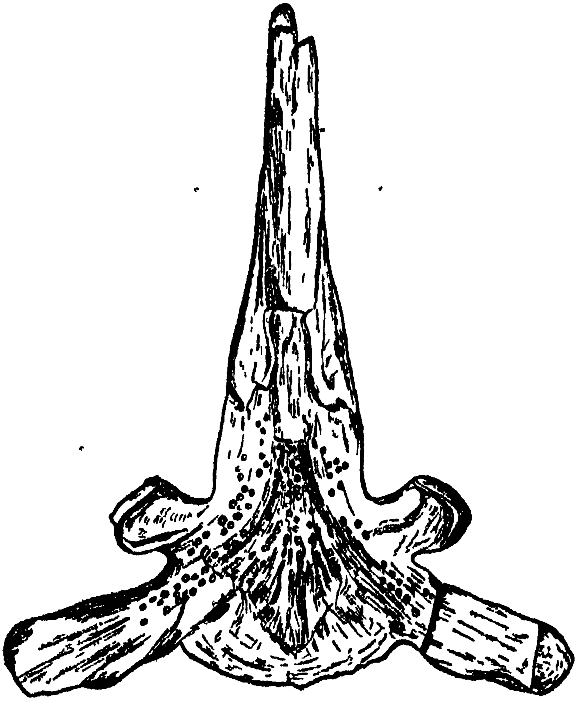
This specimen, as regards outline, is practically complete. It exhibits anteriorly the long shaft described in specimen A, and expands posteriorly as in that specimen. Both antero-lateral processes are well preserved and will be described below, and, in addition, we have also preserved in this case the posterior pair of processes, which are of a wing-like nature and extend outwards and backwards.

The anterior shaft and its side-wings as described in specimen A are here represented as cast, with the exception of a small fragment of bone at the extreme anterior end of the shaft. Hence, since the shape of the dorsal surface of the shaft has been described as convex, the present specimen simply exhibits the concavity in which it lay, and the side-wings, which in dorsal view are concave, are represented as convex surfaces.

The posterior expanded part of the bone is extremely well preserved, and gives us a ventral view of the bone whose dorsal surface has been described in A. The portion preserved includes a short stump of the shaft, which is broken off by a transverse fracture just in front of the posterior termination of its side-wings. The shaft from this fracture passes backwards and merges into a well-defined, raised, diamond-shaped area, lying in the centre of the more or less semicircular posterior expanded part of the bone. This raised area must correspond with the shallow basin-shaped area of the dorsal view. No trace is shown of a raised boss corresponding to the depression for the pituitary body, seen in dorsal view. There is, however, nothing extraordinary in this, since, even in the common snake, the extremely deep pituitary depression on the dorsal surface of the compound para-basisphenoid is not represented in ventral view by any boss or tubercle. Antero-laterally the diamond-shaped raised central area is bordered on each side by a deep valley which separates it from the anterior lateral process of each side. This valley passes outwards and backwards on the posterior flange-like side-process, where it flattens out and disappears.

Coming now to a consideration of the preserved part of the shaft, we find that it exhibits a practically flat surface, with posteriorly a rather greater prominence, and possesses numerous well-defined denticle-like prickles, best shown in that part of the shaft immediately anterior to its posterior diamond-shaped expansion. On this latter expansion there is apparently a tendency for the prickles to fuse into longitudinal, slightly diverging ridges. Numerous denticles also occur in the antero-lateral valleys mentioned above, with some slight tendency towards a linear arrangement.

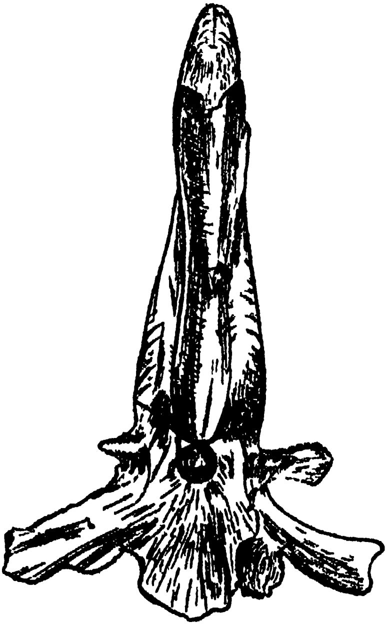
Fig. 2.



Ventral view of the compound para-basisphenoid bone of *Rhadinichthys* sp. (Specimen B.) × 7·6 diams. No. L 10821. M. M.

It now remains to consider the two pairs of lateral processes. The anterior pair pass almost directly outwards, slightly dumb-bell shaped in form—broad-based, then constricting, to expand again and end in what appears to be definite articulating facets. These anterior processes, which are stout flattened rod-like structures, are to be regarded as "basipterygoid" processes, and are of great interest on account of their articulating facets, the interest of which will be apparent when we come to deal with the homologies of this bone.

Fig. 8.



Cast of the dorsal surface of the compound para-basisphenoid bone of *Rhadinichthys monensis* showing the well-defined pituitary region. (Specimen C.) × 7·6 diams. No. L 10822. M. M.

The posterior pair of lateral processes are flat thin flanges of bone which project outwards and backwards, and possess on their surface a few indefinite ridges.

This completes the account of the dorsal and ventral views of the bone, but a few remarks may be added on specimen C. This is an almost complete cast of the dorsal surface of the bone, only a few small fragments of actual bony material being still adherent. The dorsal surface has already been described from A, but this specimen is interesting in giving us an excellent cast of the complete pituitary region, appearing as a well-defined boss, surrounded by a sharp depressed ring, *i. e.* the reverse of the actual features. Immediately in front of the pituitary region the cast exhibits a well-defined, symmetrically disposed, shallow V-shaped line, which may possibly represent the line of junction, on the dorsal surface of the para- and basi-sphenoids. The anterior pair of lateral processes is only fairly well preserved in impression, but the posterior pair is much more perfectly cast, the extremity o the right-hand process being accurately shown, a feature no definitely shown in specimen B.

Having described the three specimens, it now remains to consider their homologies. Are they simply "parasphenoids" in the restricted sense of the term—as applied to the so-called "membrane" bone of that name—or do they represent a fusion of membranous parasphenoid elements with one or more cartilaginous elements of the basis cranii?

This question is best approached by comparing the present specimens with the structures to be observed in other fishes, and also in the Amphibia and Reptilia.

When we make such a comparison, we find that the contours of the above-described specimens are more or less completely imitated by those of the corresponding bone of certain Fishes, Amphibians, and Reptiles. All three groups possess a bone on the ventral surface of the cranium, having anteriorly a narrow pointed shaft, which expands posteriorly to form a more or less square plate, which possesses usually two pairs of lateral processes.

In living fishes and Amphibia this is a definite, very well-defined membrane-bone, and there is no distinct ossified basisphenoid, although rudimentary ossified structures have been found in several Teleosts, and in *Amia* only amongst the Ganoids, indicating the presence of paired basisphenoids.

In living reptiles the bone which has an exactly similar configuration to the "parasphenoid" of the lower groups is termed the basisphenoid. The general statement made is "that the parasphenoid bone, so characteristic of the Amphibia, is for the most part very much reduced in reptiles or it may be entirely wanting." Now there are only two possible solutions to fit the case in reptiles, both of which may be correct, however. One is that the parasphenoid is a degenerating structure, as the above general statement might lead one to expect; the second, that the parasphenoid may have fused with the basisphenoid.

It certainly seems remarkable that, although the parasphenoid is regarded as a disappearing bone in Reptilia, yet it is replaced by a bone—the basisphenoid—which is practically identical with the parasphenoid of Fishes and Amphibia, as applied especially to fossil representatives of these groups. This would lead one to expect a fusion of the basisphenoid with the parasphenoid, rather than a degeneration of the latter bone.

Now this fusion can actually be traced in the development of reptiles, *e. g.* the primitive *Sphenodon*, snakes, &c.

Swinnerton and Howes (3) indicate that in *Sphenodon* a fusion of basisphenoid and parasphenoid takes place to form one bone, which in the adult resembles the "basisphenoid" of snakes. At their development stage T the parasphenoidal splint is still independent of the overlying pre-sphenoidal cartilage, but presumably this latter is finally completely underlaid or even embraced by extension of the parasphenoidal shaft.

Parker (4) shows that in the common snake the parasphenoid arises as "a long styloid tract of granular tissue wedged between the trabeculæ and reaches the pituitary body by its broad hinder end," *i. e.* this tract is situated in the fore-half of the basis cranii, and later becomes a sharp style of bone which broadens out under the pituitary space. At Parker's Stage 4 the basisphenoid is seen to arise as "paired symmetrical films of bone, on the outer margin of the trabeculæ where the latter pass into the basal plate." At Stage 5 these films "have grown inwards to meet and form one large bone, the basisphenoid proper." It occupies the roots of the trabeculæ, but stops in front opposite the end of the parasphenoid. At Stage 8 "the basisphenoid is now a compound bone, it was made from the two proper basisphenoid centres and has gained a bulging floor and a large carinate rostrum from the parasphenoid. But neither the parasphenoid nor the basisphenoid directly floor the cranial cavity." In this case there is no pre-sphenoidal cartilage.

In the above-quoted cases, therefore, it is evident that, in the basisphenoid, we are dealing with a compound parabasisphenoid.

Dealing now with the fossil Reptilia, we find that the parasphenoid is best developed in the Plesiosaurs, where it extends forwards from the basisphenoid between the pterygoids, and, as usual, the parasphenoid partly underlies the basisphenoid to which it is adherent.

In the Squamata, Ichthyosauria, and most early reptiles, the parasphenoid appears as a more or less slender shaft or process in front of the basisphenoid. For the Ichthyosauria the para-basisphenoid of *Ophthalmosaurus* (5) may be taken as a type, and for the Sauropterygia that of *Tricleidus* (5).

Thus there is a characteristic form amongst the Reptilia for the compound para-basisphenoid bone, compound as we know from a study of fossil and recent types.

Coming now to a consideration of the Amphibia, we find that the living Amphibia are much too specialised to be of much assistance. All the Anura possess a characteristic T-shaped bone termed the parasphenoid, with the cross of the T directed posteriorly. There is no trace apparently of any basisphenoid.

When we turn to the fossil Amphibia, we find a much more satisfactory state of affairs. Watson (6), speaking of *Loxomma*, says: "the basisphenoid, parasphenoid, and ethmoid are fused together and only their lower surface is well seen. The back of the basisphenoid is recessed for the anterior end of the basi-occipital, and what is presumably the posterior end of the parasphenoid projects backwards covering the lower surface of the latter bone." This backward projection of the parasphenoid (though not to underlie the basi-occipital) is exactly paralleled in *Ophthalmosaurus*, certain of the Sauropterygii, and even in *Sphenodon* itself. Further, "the sides of the basisphenoid slope upwards, passing imperceptibly into the opisthotic and pro-otic. On each side of the bone in the region of the pituitary fossa is a powerful process, the processus basipterygoideus, which has a well-marked, smooth, articulating surface on its antero-lateral side: deeply impressed on the bone on the inner side of each of these processes is a groove which leads round from the side of the basis cranii to open in front into a foramen passing through the bone, which is undoubtedly the carotid foramen." Anteriorly to this the bone takes the form of a narrow pointed splint exactly like those of the reptiles quoted above: hence the general form of this bone in *Loxomma* is exactly like that to be found in the reptiles. *Pteroplax*, in the same paper by Watson, is stated to have a very similar basis cranii. Finally, Fritsch (7) figures numerous bones in the Branchiosauridæ, &c., of the same general form as the compound para-basisphenoid of the snake, and to these applies the term "parasphenoid."

Coming now to the fishes themselves, and the primitive Teleostomes in particular, we find that Watson (6), speaking of *Megalichthys*, says: "the basisphenoid of *Megalichthys* has sometimes carotid foramina just as in *Loxomma*. It has small but distinct basipterygoid processes which are, however, not provided with articulating surfaces but with sutural ones. The long parasphenoid extends forwards to the premaxillæ as it may do in *Pteroplax*, and its lateral borders are in contact with the pterygoids to which they afford support."

Here, again, the para-basisphenoid elements have apparently the characteristic form with which we are dealing; and once having assumed that in *Loxomma* the posterior expansion is basisphenoid, the assumption is also made in the case of a similar expansion with processes and foramina in *Megalichthys*. That the assumption is correct in the case of *Loxomma* there can be little doubt, from a consideration of primitive Reptilian structures.

Bones of the basi-cranial axis in fishes are rarely preserved, however; in fact, the present specimens, so far as can be ascertained, are almost unique in their perfect preservation. Even the examples found by Fritsch lacked the side-processes in every case, judging by his figures; but, nevertheless, the specimens were well enough preserved to cause Fritsch on several occasions to comment on their remarkable resemblance to the parasphenoid of the Branchiosauria, by which, presumably, he would mean the compound para-basisphenoid as described by Watson for *Loxomma* and *Pteroplax*.

One definite fact seems to emerge from a consideration of the above points, and that is, that certain primitive fossil fishes of the Ganoid group, certain of the primitive fossil Amphibia—the Branchiosauria in particular,—and both living and fossil Reptilia, exhibit a bone on the ventral surface of the cranium, possessing the same general form, the same relationships, and all agreeing, as will be gathered from the above, in representing in each group a compound para-basisphenoid, the parasphenoid in each case having a broadened posterior extension underlying the basisphenoid. *Megalichthys* stands as a type for the fishes, *Loxomma* and *Pteroplax* for the early Amphibia, *Ophthalmosaurus* and *Tricleidus* for the fossil, and the Common Snake and *Sphenodon* for the recent reptiles.

The present specimens make the case even more conclusive, since in A and C we have the pituitary region well marked out as already described. Now the pituitary body always comes into relationship with that part of the cartilaginous basis cranii which later ossifies to form the basisphenoid. Hence, in the present specimens we must assume that in A, in the pituitary region, we have the actual dorsal surface of the basisphenoid preserved. The depression for the pituitary body does not affect the ventral surface of specimen B, because the actual basisphenoid is underlaid by a posterior broadened extension of the anterior shaft, which shaft and extension we must recognize as the parasphenoid on account of the dentate surface already described, and also by analogy with the structures described above for Fishes, Amphibia, and Reptiles.

I think the evidence may be accepted as conclusive that specimens A, B, and C are actually compound bones built up of a posterior basisphenoid and an anterior shaft-like parasphenoid, which, however, has a posterior extension underlying the basisphenoid and fused with it; and so we arrive at the homology existing between the above specimens and the similar bone in such types as *Megalichthys*, *Loxomma*, *Ophthalmosaurus*, and the snake.

Only one other point remains to be dealt with, and that is a consideration of the anterior lateral processes of the present specimens, which exhibit definite articulating facets. The bones with which these processes articulated are unfortunately not sufficiently preserved to allow of their characters being determined, but there is little doubt but that they are the pterygoids.

These anterior lateral processes have an interesting bearing on the question of the autostylic and hyostylic modes of suspension of the jaws.

Parker (8) and Swinnerton (9) have shown that *Lepidosteus* and *Amia* possess similar processes from the trabeculæ which articulate with a process (the "pedicle") of the palato-quadrate bar. Swinnerton discusses fully the importance of this connexion between the basis cranii and the palato-quadrate bar. Dealing with the Teleostomi, he shows that there has been in the Teleosts a gradual reduction in the metapterygoid region of the palato-quadrate bar, concurrently with an increase in the importance of the hyomandibular. He also notes that in those lowly forms in which the metapterygoid region is large, a pedicle is sent off from its upper border towards the trabeculæ, and the trabeculæ have on each side a projecting process to meet this pedicle.

The evidence, Swinnerton says, "suggests that at some former time an actual connection or articulation must have existed between the pedicle [of the palato-quadrate bar] and the trabeculæ." As already noted, Parker indicates that such a condition exists in *Lepidosteus*, in which at all stages from the embryo, two-thirds of an inch long, up to the adult condition, there is a strongly developed pedicle forming an articulation with the "basipterygoid" process. He says: "the proximal part of each trabecula has developed an oblong facet of cartilage for articulating with the pedicle of the suspensorium."

Swinnerton notes that Smith Woodward has discovered that in *Lepidotus* there is a stout process of the metapterygoid which bears a large facet which may have articulated with a lateral element in the cranium. Swinnerton believes that this process is the homologue of the podicle of the palato-quadrate bar in *Lepidosteus*. After a considoration of Smith Woodward's description and figures (10) it becomes difficult, however, to suppose that the "lateral element in the cranium," mentioned by him, can represent the basipterygoid processes as in *Lepidosteus*, since in *Lepidotus* he figures well-developed basipterygoid processes of the "parasphenoid" which apparently have sutural terminations, and therefore could not have been apposed to the facet which is found on the anterior process of the metapterygoid, though there can be little doubt that these basipterygoid processes united with the pterygoid region.

Watson has shown that *Megalichthys* has similar processes from the basisphenoid region of the basis cranii, and that these have a sutural union with the pterygoid region, and that *Loxomma* and *Pteroplax* also possess exactly similar processes of the "basisphenoid" articulating with the same region. In the present specimens the basipterygoid or anterior lateral processes bear articulating faces, and, we may take it, correspond with those of *Lepidosteus*, *Lepidotus*, and *Megalichthys* amongst fishes, and with the similar processes of the basisphenoid region as described by Watson in *Loxomma*, *Pteroplax*, and *Batrachiderpeton* amongst the fossil Amphibia, and in which the articulation is by facet with the pterygoid region.

It appears, then, that the additional pedicular articulation of the palato-quadrate region with the trabeculæ is simply continued in an homologous form in the union of pterygoid region with the basipterygoid processes, a union by facet or suture.

Swinnerton notes that in the Selachii also there is a constant recurrence of this pedicle of the palato-quadrate region, pointing back to an ancestor "which certainly possessed that feature."

In that case, on the evidence brought forward above, we have a line passing from the Selachii through the primitive Teleostomes to the primitive Amphibia and Reptilia, on which line there is this characteristic pedicular connexion between the palato-quadrate region and the trabeculæ of the chondrocranium, and hence these groups all agree in possesing this distinctive type of "autostyly." This points very strongly to an affinity along this line and to a derivation of the Tetrapoda from some group of primitive Teleostomes.

It is to be noted also that this characteristic "autostyly" we have traced, is not the "autostyly" of the Dipnoi, nor does it agree with the condition in the Tetrapoda to which that term is usually applied. In the former group the quadrate region of the palato-quadrate bar is directly fused to the auditory capsule; in the latter the primitive mode of attachment, as Watson has shown for *Loxomma*, *Batrachiderpeton*, &c., is for the quadrate region to come into connexion, not with the auditory capsule, but with the dermal cheek-bones—the squamosals.

We have therefore three distinct methods by which the palato-quadrate bar has come to possess an "autostylic" suspension, and, since this same term has been applied indiscriminately to all three, considerable confusion exists in consequence.

The foregoing observations have thus supported two strong arguments in favour of a primitive Teleostome, and against a Dipnoan, derivation of the Tetrapoda:—

(1) The compound para-basisphenoid bone has a similar form in primitive Teleostomes and all primitive Tetrapoda, while the corresponding bone of the Dipnoi is totally different.

(2) In both primitive Teleostomes and Tetrapoda the palato-quadrate has a "pedicular" autostylic suspension, while the type of autostyly present in Dipnoi is not found in Tetrapoda.

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LIII.—*Notes on Fossorial Hymenoptera.*—XVIII. *On the Australian Species of* Bembex. By Rowland E. Turner, F.Z.S., F.E.S.

So little was known of the Australian species of *Bembex* at the time of Handlirsch's fine monograph of the genus (1893), that I think a key including the species since described, and also those described by Smith, most of which were not known to Handlirsch, may be useful. The genus is not so well represented in Australian collections as should be the case; probably this is due to the extreme rapidity of flight rendering capture difficult, for in sandy localities many of the species are very common. They burrow in sand, often in colonies—that is, a number of specimens form burrows close together in suitable localities. Little is known of the habits of Australian species, but in other countries the burrows are often left open and fresh flies supplied to the larva daily. Further collecting will doubtless result in the discovery of more species.

Key to the Australian Species of Bembex.

♂♂.

1	Anterior femora serrate	*B. egens*, Handl.
	Anterior femora not serrate	2.
2.	Spur of fore tibia much dilated and flattened	3.
	Spur of fore tibia not roundly dilated ..	4.
3.	Bands of apical dorsal segments interrupted	*B. calcarina*, Handl.
	Bands of apical dorsal segments continuous	*B. flaviventris*, Sm.
4.	Second ventral segment with a small tubercle on each side of the large median tubercle .... ,..	*B. lobimana*, Handl.
	Second ventral segment without lateral tubercles	5.
5.	Basal joint of fore tarsus strongly dilated.	6.
	Basal joint of fore tarsus not dilated....	9.

6. Clypeus and labrum deeply longitudinally grooved on each side .... 7.
   Clypeus and labrum without grooves .. 8.
7. Labrum with a narrow median groove at the base .... *B. flavifrons*, Sm.
   Labrum without a median groove ...... *B. pectinipes*, Handl.
8. Second and third joints of fore tarsus very strongly produced outwards; basal joint of intermediate tarsus dilated; fourth dorsal segment with a pale fascia .... *B. palmata*, Sm.
   Second and third joints of fore tarsus normal; basal joint of intermediate tarsi not dilated; fourth dorsal segment entirely black .... *B. vespiformis*, Sm.
9. Second ventral segment with a raised transverse lamella .... *B. lamellata*, Handl.
   Second ventral segment with a longitudinal carina or tubercle .... 10.
10. Tubercle of the second ventral segment bifid at the apex .... *B. furcata*, Erichs.
    Tubercle of the second ventral segment not bifid .... 11.
11. Sixth ventral segment normal, without a carina or raised triangular area .... 12.
    Sixth ventral segment with a carina or raised triangular area.............. 19.
12. Intermediate femora serrate .... 13.
    Intermediate femora not serrate ...... 18.
13. Three basal dorsal segments with broad orange bands .... *B. aureofasciata*, Turn.
    Without orange colouring............ 14.
14. Labrum and clypeus black............ 15.
    Labrum and clypeus yellow .... 17.
15. The serration of the intermediate femora extending to the apex; pale markings on abdomen almost or quite obsolete . *B. funebris*, Turn.
    The intermediate femora serrate in the middle only; pale markings of the abdomen more developed .... 16.
16. Black lobes of the basal joint of the fore tarsus well developed and clearly divided, intermediate and hind legs mostly yellow .... *B. atrifrons*, Sm.
    Black lobes of fore tarsus not clearly divided; intermediate legs mostly, hind legs wholly black .... *B. severa*, Sm.
17. Serration of the intermediate femora well developed and extending to the apex; thorax and abdomen black, with a few narrow abdominal fasciæ .... *B. trepida*, Handl.
    Serration of intermediate femora nearly obsolete and not extending to apex; thorax and abdomen mostly yellow .. *B. latifasciata*, Turn.
18. Abdominal fasciæ very broad, yellowish green; sixth ventral segment emarginate at the apex, seventh dorsal segment sinuate at the sides .... *B. marsupiata*, Handl.

Abdominal fasciæ narrow and pale; sixth ventral segment not emarginate, seventh dorsal segment not sinuate at the sides .... *B. cursitans*, Handl.

19. Sixth ventral segment with a raised, flattened, triangular tubercle........ 20.
Sixth ventral segment with a low longitudinal carina .... 25.

20. Clypeus pure white, with a black basal fascia, subconcavely truncate anteriorly; apical joint of antennæ strongly bent and pointed, three subapical joints strongly spined .... *B. flavipes*, Sm.
Clypeus and antennæ differing from the above characters .... 21.

21. Tubercle of second ventral segment not much curved, broadly truncate at the apex .... 22.
Tubercle of second ventral segment strongly curved, pointed at the apex . 23.

22. Abdomen yellow beneath; basal joint of the anterior tarsi with eight spines. *B. tuberculiventris*, Turn.
Abdomen black beneath; basal joint of the anterior tarsi with six spines . .. *B. mackayensis*, Turn.

23. Clypeus, scape beneath, and legs almost entirely yellow .... *B. littoralis*, Turn., var.
Clypeus and legs mostly black, scape entirely black .... 24.

24. Eighth and ninth joints of the antennæ prominent behind .... *B. musca*, Handl.
Eighth and ninth joints of the antennæ not prominent . .. . *B. littoralis*, Turn.

25. Seventh dorsal segment broadly rounded at the apex; abdomen entirely black. *B. leeuwinensis*, Turn.
Seventh dorsal segment narrower, truncate at the apex, or feebly emarginate. 26.

26. Abdominal fasciæ interrupted, not very broad............ .. .. *B. variabilis*, Sm.
Abdominal fasciæ continuous, very broad. *B. raptor*, Sm.

♀♀.

1. Basal joint of the fore tarsus with twelve or more spines. .. . . 2.
Basal joint of fore tarsus with six to eight spines .... 3.

2. Clypeus and labrum with a deep longitudinal groove on each side .... *B. flavifrons*, Sm.
Clypeus almost, labrum quite without grooves .... *B. pectinipes*, Handl.

3. Discal area of the mesonotum marked with yellow.... . ... 4.
Discal area of the mesonotum without yellow markings......... .... 11.

4. Sixth dorsal segment with yellow markings .... 5.
Sixth dorsal segment entirely black.... 10.

5. Abdominal fasciæ very broad, occupying at least half the length of the segment. 6.

	Abdominal fasciæ narrower	9.
6.	Sixth dorsal segment with a large median spot	7.
	Sixth dorsal segment with a spot on each side	8.
7.	Sixth dorsal segment broadly rounded at the apex	*B. lobimana*, Handl.
	Sixth dorsal segment narrowly rounded at the apex	*B. marsupiata*, Handl.
8.	Second ventral segment entirely yellow	*B. latifasciata*, Turn.
	Second ventral segment black in the middle and at the base	*B. raptor*, Sm.
9.	Abdominal fasciæ continuous	*B. flaviventris*, Sm.
	Abdominal fasciæ narrowly interrupted	*B. flavipes*, Sm.
10.	Tibiæ entirely yellow; basal joint of fore tarsus with seven spines. Large, 17 mm. in length	*B. palmata*, Sm.
	Tibiæ with broad black line; basal joint of fore tarsus with six spines. Smaller, 13 mm. in length	*B. littoralis*, Turn., var.
11.	Third and fourth dorsal segments entirely black, first with a broad fascia	*B. vespiformis*, Sm.
	Third dorsal segment at least with a fascia, when the fourth is entirely black, then the first also without a fascia	12.
12.	Clypeus and labrum entirely black	13.
	Labrum at least yellow	14.
13.	Thorax entirely black	*B. leeuwinensis*, Turn.
	Thorax with lateral yellow spots on mesonotum and scutellum	*B. severa*, Sm.
14.	Clypeus entirely black	*B. atrifrons*, Sm.
	Clypeus at least partially yellow	15.
15.	Eyes strongly convergent above, second ventral segment with a low carina from the base	*B. cursitans*, Handl.
	Eyes not strongly convergent above	16.
16.	With a small yellow spot on each side of the anterior ocellus. Length never exceeding 15 mm.	17.
	Without a yellow spot on each side of the anterior ocellus. Length always exceeding 15 mm.	*B. furcata*, Erichs.
17.	Third cubital cell distinctly longer on the radius than on the cubitus	*B. variabilis*, Sm.
	Third cubital cell no longer on the radius than on the cubitus, if as long	*B. mackayensis*, Turn.

I have not seen *B. lamellata*, Handl., so cannot include the female in my key. The species of the *musca* group are so close that I cannot tabulate the females on the insufficient material available. Some of the species of this group appear to have the spines of the fore tarsi much more strongly spatulate than others; colour is very variable and not reliable in distinguishing these species.

Bembex egens, Handl.

Bembex egens, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 753 (1893). ♂.

Hab. Australia.

I have not seen this species, which belongs to the same group as *flaviventris*, Sm., but may be distinguished from all other Australian species by the serration of the anterior femora. No definite locality is known.

Bembex calcarina, Handl.

Bembex calcarina, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 754 (1893). ♂.

Hab. Adelaide.

This species, of which I have not seen specimens, is very near *flaviventris*, Sm., from which it may be distinguished by the interrupted bands on the apical dorsal segments, which are continuous in that species. There is no mention in Handlirsch's description of any abnormal structure of the apical joint of the intermediate tarsus, which in *flaviventris* is very long and slender at the base. Handlirsch, in his key, refers under *calcarina* to his figure of an intermediate metatarsus which, according to the plate and description, belongs to *egens*. This is evidently a slip, the only one I have yet found in the work of that author.

Bembex flaviventris, Sm.

Bembex flaviventris, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 299 (1873). ♂ ♀.

This is very near *calcarina*, Handl., which may prove to be a synonym or subspecies. I have not taken the species myself.

Hab. Southern Cross, W.A.; Perth, W.A.

Bembex palmata, Sm.

Bembex palmata, Sm. Cat. Hym. B.M. iv. p. 325 (1856). ♂.
Bembex tridentifera, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 298 (1873). ♀.

Hab. Mackay, Q.; Toowoomba, Q.; Moruya, N.S.W.; Victoria.

The male is easily distinguished from *flavifrons* by the normal clypeus and labrum and by the fewer spines on the basal joint of the fore tarsus. It is nearer in structure to *vespiformis*, Sm., but differs conspicuously in the colouring of the abdomen, in the much broader joints of the fore tarsus, and in the acute spine of the eighth ventral segment.

Bembex vespiformis, Sm.

Bembex vespiformis, Sm. Cat. Hym. B.M. iv. p. 327 (1856). ♀ ♂; Handl. Sitzber. Akad. Wiss. Wien, cii. p. 93 (1893).

Hab. Adelaide (*Smith*), type ♂; Townsville, Q. (*Dodd*); Kalamunda, W.A. (*Turner*); Waroona, W.A. (*Berthoud*).

This species is easily distinguished by the broad band on the basal dorsal segment, sometimes the second and third dorsal segments also have narrow bands, often interrupted, the fourth always without a band; scutellum with a spot on each side, mesonotum immaculate. The male structural characters are the very broad basal joint of the fore tarsus, which has seven spines on the outer margin and is edged with black near the apex; the seventh joint of the flagellum strongly excised beneath, with a strong spine at the base, eighth joint with a minute spine at the base; second ventral segment with a strong tubercle, sixth and seventh unarmed; apical spine of the eighth stout, truncate or feebly bilobed at the apex. West Australian males have the seventh dorsal segment mostly, the sixth and the apex of the fifth entirely, brownish yellow; in Adelaide and Queensland specimens the seventh and fifth are black, with two yellow spots on the seventh in one Queensland specimen, the sixth sometimes with a yellow apical band, sometimes without. It appears to me that the stipes of the genitalia in the Adelaide form are distinctly broader than in the West Australian specimens and also somewhat different in sculpture. In Queensland specimens the wings are infuscate on the discoidal area.

Bembex flavifrons, Sm.

Bembex flavifrons, Sm. Cat. Hym. B.M. iv. p. 324 (1856). ♀.
Bembex saussurei, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 873 (1893). ♀.

Hab. Adelaide (*Smith, Handlirsch*); Mackay, Q. (*Turner*); Port Denison, Q. (*Handlirsch*).

The distinguishing characters are the deep, lateral, longitudinal furrows on the labrum and clypeus; the large number of spines on the basal joint of the fore tarsus, eighteen in the male, thirteen in the female; the form of the seventh tergite of the male, strongly produced at the apex and truncate, deeply sinuate at the sides and slightly serrate above the sinuation; the anterior tibiæ of the male are produced at the outer apical angle and furnished with two long spines; the intermediate femora are feebly serrate beneath; the eighth joint of the flagellum is strongly thickened at the base and excavated. The labrum of the male has a distinct longitudinal groove from the base, which is also visible but less distinct in the female.

Bembex pectinipes, Handl.

Bembex palmata, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 298 (1873). ♂ (nec Smith, 1856).
Bembex pectinipes, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 875 (1893). ♀.

I am not quite sure that my identification of *pectinipes* is correct. The type of *palmata* is identical with Townsville specimens, and differs from ♂ *flavifrons* from Mackay in the less produced and less sinuate seventh tergite, in the absence of a longitudinal groove on the middle of the labrum, and in the greater development of the pale markings, especially in the presence of a large mark on the seventh tergite and of a large U-shaped mark on the mesonotum. The female differs in the more convex clypeus, in which the lateral grooves are almost obsolete, and in the total absence of grooves on the labrum; the pygidium has a better-defined pygidial area and is less closely punctured, and the pale markings are more strongly developed, especially on the scutellum, which has a transverse band, not merely lateral spots as in typical *flavifrons*.

Hab. Townsville, Q.; Port Darwin, N.T.

The differences between the two forms are so small compared with the many features in common, especially in the male, that I doubt if they should be treated as more than local races.

Bembex trepida, Handl.

Bembex trepida, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 759 (1893). ♂.

Hab. Adelaide, S.A.

I only know the male of this species. It is very near *atrifrons* and *funebris*, differing from the former in the serration of the intermediate femora, which reaches the apex, in the yellow colour of the labrum, clypeus, and underside of the scape; from the latter in the same points in colour, in the much less broadly rounded seventh dorsal segment, and in the much more developed black lobes of the basal joint of the fore tarsi.

Bembex severa, Sm.

Bembex severa, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 297 (1873). ♀ (nec ♂).

Hab. Swan River, W.A. (*Du Boulay*).

I think the female must be taken to be the type of this species. The male described by Smith appears to be *funebris* with more developed abdominal fasciæ, but I do not think that the female belongs to the same species, but to another male from the same collection, placed by Smith in the series. This is a more robust insect, with the serration of the intermediate femora not reaching the apex, in this point resembling *atrifrons*, from which it differs in the very slight development of the black lobes of the fore tarsus, in the more robust form, and in the more broadly rounded seventh dorsal segment. In both sexes the labrum and clypeus are black. The thorax of the male is almost entirely black, but there is a yellow spot on the tegula. The antennæ are as in *atrifrons*, but the hollowing of the apical joints is more distinct. There are seven spines on the basal joint of the fore tarsus in both sexes.

Bembex atrifrons, Sm.

Bembex atrifrons, Sm. Cat. Hym. B.M. iv. p. 327 (1856). ♀.
Bembex flavilabris, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 299 (1873). ♀.
Bembex atrifrons, Turn. Proc. Zool. Soc. London, p. 353 (1910). ♂ ♀.

Hab. South Perth (*Giles*); Yallingup and Busselton, W. A. (*Turner*).

The male has the serration of the intermediate femora not extending either to the base or apex, the intermediate tibiæ flattened broadly at the apex, the basal joint of the intermediate tarsus broadly emarginate at the base beneath, the basal joint of the anterior tarsus with seven spines on the outer margin and a row of black lobes, a faint longitudinal carina on the third ventral segment, as well as the usual tubercle on the second, the labrum black, the mandibles yellow at the base, and the scape entirely black. The female has the scape more or less yellow beneath and the labrum almost entirely yellow.

Allied to *trepida*, Handl.

Bembex funebris, Turn.

Bembex severa, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 298 (1873). ♂ (nec ♀).
Bembex funebris, Turn. Proc. Zool. Soc. London, p. 353 (1910). ♂.

Hab. South Perth, W.A. (*Giles*); Busselton, W.A. (*Turner*).

The male may be distinguished from the nearly allied *atrifrons* by the complete or almost complete absence of abdominal fasciæ, the only markings being on the legs, by the greater extent of the serration of the intermediate femora, and by the greater apical breadth of the seventh dorsal segment. The lobes of the basal joint of the fore tarsi are less developed than either in *atrifrons* or *trepida*. The female is unknown. The specimen described by Smith as the male of *severa* has the fasciæ of segments 2–4 developed, but broadly interrupted.

Bembex aureofasciata, Turn.

Bembex aureofasciata, Turn. Proc. Zool. Soc. London, p. 354 (1910). ♂.

Hab. South Perth, W.A. (*Giles*); Waroona, W.A. (*Berthoud*).

In structure this is allied to *funebris*, but may at once be distinguished by the broad orange fasciæ of the three basal dorsal segments and by the almost smooth seventh dorsal segment.

Bembex lobimana, Handl.

Bembex lobimana, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 755 (1893). ♂ ♀.

Hab. New South Wales.

I have only seen the female of this large species. The basal joint of the fore tarsus has seven spines. The clypeus of the male is much more broadly flattened in front than in the female.

Bembex marsupiata, Handl.

Bembex marsupiata, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 757 (1893). ♂ ♀.

Hab. Waroona, W.A. (*Berthoud*).

Both this species and *lobimana* have the abdominal fasciæ very broad, and have seven spines on the basal joint of the fore tarsus of the female. In *marsupiata* the female has the sixth dorsal segment more narrowly rounded than in *lobimana*.

Bembex latifasciata, Turn.

Bembex latifasciata, Turn. Ann. & Mag. Nat. Hist. (8) x. p. 57 (1912). ♂ ♀.

Hab. Strelley River, W.A. (*Giles*); Roeburne, W.A.

This belongs to the group of *lobimana* and *marsupiata*. The serration of the intermediate femora is almost obsolete, but is just visible. The tubercle at the base of the first ventral segment is much more strongly developed than in *marsupiata*, the sixth ventral segment is not emarginate at the apex as in that species. The markings on the thorax are much more strongly developed in the present species and the seventh dorsal segment is rounded at the apex, not truncate as in *marsupiata*. The female has the sixth dorsal segment narrowly rounded at the apex, with a yellow spot on each side. It is a much smaller species than *marsupiata*. There is a female of the species in the British Museum from Hermannsburg, Central Australia.

Bembex furcata, Erichs.

Bembex furcata, Erichs. Arch. f. Naturges. viii. p. 266 (1842). ♂ ♀.

Hab. Launceston, Tas. (*Simson*); Eaglehawk Neck, Tas. (*Turner*); Hobart, Tas. (*Walker*); Cottesloe, W.A. (*Giles*); Woodford, N.S.W. (*G. A. Waterhouse*); Leura, N.S.W. (*Froggatt*).

This is one of the commonest species in the southern portion of Australia, though rare in the south-west. It appears to be the only representative of the genus in Tasmania. The male is easily distinguished by the furcate tubercle of the second ventral segment; the sixth ventral segment is armed with a transverse ridge produced in the middle into a rounded tubercle. The labrum usually, and often the clypeus, of the male is black, of the female yellow.

Bembex cursitans, Handl.

Bembex cursitans, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 762 (1893). ♂ ♀.

Hab. Yallingup, W.A. (*Turner*); South Perth, W.A. (*Giles*).

This is a common species in South-western Australia. The male has a large tubercle on the second ventral segment, a low longitudinal carina on the third, and the sixth unarmed. The seventh dorsal segment is truncate at the apex. The eyes are more strongly divergent towards the clypeus in both sexes than in other species.

Bembex flavipes, Sm.

Bembex flavipes, Sm. Cat. Hym. B.M. iv. p. 325 (1856). ♀; Turn. Proc. Zool. Soc. London, p. 502 (1908). ♂.

Hab. Mackay, Q. (*Turner*); Townsville, Q. (*Dodd*); Alexandria, N.T. (*Stalker*); Adelaide River, N.T. (*Walker*).

The male is easily distinguished by the white clypeus, which has a black band at the base and is almost vertically truncate anteriorly, the face of the truncation subconcave and the apex widely and shallowly emarginate. There is a large tubercle on the penultimate joint of the antennæ, and the apical joint is very sharply bent in the middle, the apical point being almost at right angles to the rest of the joint. The ventral surface of the abdomen is armed as in the *musca* group with a large tubercle on the second segment, truncate at the apex, and a flat triangular tubercle on the sixth segment. The female has the clypeus yellow, with a more or less defined Λ-shaped black mark at the base, strongly convex, the anterior tarsi with six spines on the basal joint, and the sixth dorsal segment marked with two yellow spots. In both sexes the ventral surface of the abdomen is almost entirely yellow. The female might possibly be confused with some of those of the *musca* group, but the markings are much more extensive and the form of the clypeus different.

Bembex musca, Handl.

Bembex musca, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 844 (1893). ♂.

Hab. Australia.

I have not been able to identify this species with any certainty. It is very near *B. littoralis*, Turn., but seems to differ a little in the structure of the eighth and ninth joints of the antennæ. The male only is described.

Other closely allied species in this group are:—

Bembex littoralis, Turn.

Bembex littoralis, Turn. Proc. Zool. Soc. London, p. 502 (1908). ♂.

Hab. Port Darwin, N.T.

This species has the tubercle of the second ventral segment curved and acute as in *B. musca*. A form from Perth, apparently a variety, has the markings strongly developed and the clypeus yellow.

Bembex mackayensis, Turn.

Bembex mackayensis, Turn. Proc. Zool. Soc. London, p. 351 (1910). ♂ ♀.

Hab. Mackay and Cairns, Q. (*Turner*).

Bembex tuberculiventris, Turn.

Bembex tuberculiventris, Turn. Proc. Zool. Soc. London, p. 503 (1908). ♂.

Hab. Cooktown, Q.

The two last species have the tubercle on the second ventral segment truncate at the apex, not acute as in *musca*; *tuberculiventris* also has eight spines on the basal joint of the anterior tarsi, not six as in the other species of the group. The ventral abdominal segments are nearly entirely yellow in *tuberculiventris*, black in *mackayensis*. In the shape of the tubercle these two species somewhat resemble *flavipes*, Sm., but the clypeus and antennæ are very different.

The number of females of the *musca* group available is very small, and the colour and markings vary much in the same species. Except in the case of *mackayensis* I do not feel sufficiently certain as to the correct association of the sexes to venture to describe them. A form of which I possess both sexes from Perth and Kalamunda, W.A., and which I take to be a highly coloured variety of *littoralis*, Turn., has the markings on the disc of the mesonotum and on the five basal dorsal segments of the female well developed, also on the six basal segments of the male, the clypeus in both sexes being yellow with a small black mark on each side near the base, and the fore tarsi in both sexes are without the black marginal line which is present in specimens of *littoralis* taken in the same locality. I have referred to this form in my key as a variety of *littoralis*, but it is quite possible that it may prove to be distinct when specimens are available for the dissection of the male genitalia.

Bembex lamellata, Handl.

Bembex lamellata, Handl. Sitzber. Akad. Wiss. Wien, cii. p. 842 (1893). ♂ ♀.

Hab. Adelaide, S.A.

I have not seen this species.

Bembex variabilis, Sm.

Bembex variabilis, Sm. Cat. Hym. B.M. iv. p. 325 (1856). ♀.
Bembex crabroniformis, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 290 (1873). ♂.

Hab. Mackay, Q. (*Turner*); Townsville, Q. (*Dodd*); Port Darwin, N.T. (*G. Turner*); Baudin Island, N.W.A. (*Walker*); South Perth, W.A. (*Giles*); Waroona, W.A. (*Berthoud*); Yallingup, W.A. (*Turner*); Adelaide, S.A. (*Handlirsch*); Hunter River, N.S.W. (*Smith*).

I can see no structural differences between *variabilis*, Sm., and *raptor*, Sm., in the male sex, but have not been able to examine the genitalia. At one time I thought they might prove to be local races of one species, but I have since taken both forms on the same day in King's Park, Perth. The male *variabilis* has the abdominal fasciæ interrupted and the basal joint of the anterior tarsus bordered with black on the outer edge; the thoracic markings are also less developed than in *raptor*. These colour-differences also exist in the female, in which sex also the second ventral segment is more sparsely punctured in *raptor* than in *variabilis* and the sixth dorsal segment slightly broader in *variabilis*.

Bembex raptor, Sm.

Bembex raptor, Sm. Cat. Hym. B.M. iv. p. 326 (1856). ♂.

Hab. Adelaide, S.A. (*Smith*); Killalpanina, E. of Lake Eyre, S.A. (*Hillier*); Hermannsburg, N.T. (*Hillier*); Alexandria, N.T. (*Stalker*); South Perth, W.A. (*Giles*); Nicol Bay, W.A. (*Du Boulay*); Townsville, Q. (*Dodd*).

This seems to be the commonest form in Central Australia. Handlirsch seems to include it in his description of the very closely related *variabilis*.

Bembex leeuwinensis, sp. n.

♂. **Niger; mandibulis in medio sordide albidis; orbitis interioribus angustissime, tibiis tarsisque anticis subtus, tibiisque intermediis subtus basi flavis; tarsis apice brunneis; alis hyalinis, venis fusco-ferrugineis.**

♀. Mari similis; segmentis dorsalibus secundo tertioque fascia transversa angusta undulata utrinque sordide albidis.
Var. ♂. Clypeo labroque plus minus sordide albidis.
Long., ♂ ♀, 14–15 mm.

♂. Antennæ normal, the apical joint stout, not curved, blunt at the apex. Clypeus rather strongly convex, truncate at the apex, depressed on the middle of the apical margin. Eyes diverging slightly below. Basal joint of fore tarsus with seven spines; intermediate femora not serrate. Second ventral segment unarmed, sometimes with a very obscure longitudinal carina; sixth ventral segment with an obscure longitudinal carina, sometimes almost obsolete, also with an obscure oblique carina on each side converging towards the apex, the enclosed space more sparsely punctured than the rest of the segment, the apical margin of the segment slightly undulating; seventh ventral segment with a well-marked longitudinal carina; seventh dorsal segment broadly rounded at the apex. Anterior wing nearly two-and-a-half times as long as the breadth of the thorax, third cubital cell about equally long on the radius and on the cubitus.

♀. Seven spines on the basal joint of the anterior tarsus; second ventral segment sparsely punctured in the middle, more closely and finely on the sides; sixth ventral segment convex, subcarinate longitudinally in the middle; sixth dorsal segment narrowly rounded at the apex.

Hab. Yallingup and Busselton, W.A.; December and January (*Turner*).

This belongs to the group of *B. variabilis*, but is easily distinguished by the difference in colour, by the much less developed carina of the second ventral segment, and by the different shape of the seventh dorsal segment. The female has the sixth dorsal segment more rounded at the apex than in *variabilis* and much more sparsely punctured.

LIV.—*A new Bat from Northern Nigeria.*

By Oldfield Thomas.

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Scotœcus falabæ, sp. n.

A medium-sized brown species, rather larger than *S. hirundo*.

General characters very much as in *S. hirundo*, to which the new form is most nearly allied. Size rather larger.

Fur 3·5 mm. in length on the shoulders. General colour sepia-brown, but the light bases of the hairs showing through, especially across the shoulders, where the hairs are prominently buffy whitish for the greater part of their length, the tips only brown. Under surface dull buffy whitish, the throat clearer white, but nowhere so pure a white as in *S. hirundo.* Membranes blackish brown throughout. Tragus short, broad, rounded, slightly incurved, the inner margin concave. Wings to the end of the metatarsus. A distinct postcalcarial lobule present.

Skull, as compared with that of *S. hirundo,* larger, more rounded, higher, and less flattened than in *S. hirundo,* and still more so in comparison with the other species. The interorbital broadening less noticeable than in any known species.

Dentition as in *S. hirundo,* except that minute anterior premolars are present on each side, standing in the notch in the posterior base of the canines.

Dimensions of the type (the italicized measurements taken in the flesh):—

Forearm 36 mm.

Head and body 51 ; tail 36 ; ear 12 ; third finger, metacarpus 34, first phalanx 11·2; lower leg and hind foot (c.u.) 20.

Skull : occiput to base of canine 13·7 ; condylo-basal length 13·3; interorbital breadth 6·8 ; intertemporal breadth 4·8 ; breadth of brain-case 8·5 ; front of canine to back of m^3 5·6 ; front of p^4 to back of m^2 3·7.

Hab. Kabwir, Northern Nigeria. Alt. 2500′.

Type. Young adult female. B.M. no. 15. 10. 8. 1. Original number 70. Collected July 28, 1915, and presented to the National Museum by Dr. J. C. Fox.

This species differs from *S. hirundo* by its larger size, higher skull, and more obviously bicolor fur. The type of *S. hirundo* is a very old female with worn teeth.

The inconvenient variability in the presence or absence of the small upper premolars is a character of *Scotæcus* unique in the Vespertilionidæ. How far these teeth will prove to be generally constant within each species remains to be seen, but in *S. hindei,* at least, they are absolutely inconstant.

The specific name is given in commemoration of Dr. Fox's escape from the peaceful liner 'Falaba,' barbarously sunk on its way out to Africa.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[EIGHTH SERIES.]
No. 96 DECEMBER 1915.

LV.—*A new African Earthworm, collected by Dr. C. Christy for the Congo Museum; with a Note on its Spermathecæ and Spermatophores.* By H. A. Baylis, B.A.

(Published by permission of the Trustees of the British Museum.)

A small collection of earthworms made in the Belgian Congo by Dr. Cuthbert Christy, for the Congo Museum at Tervueren, has been sent to the British Museum for examination and report. I am indebted to the Belgian Colonial Administration for permission to describe any new species.

The earthworms, to the number of fifteen specimens, one of which is immature, prove all to be referable to the same species. It belongs to the very large and widespread genus *Dichogaster*, Beddard, of which already upwards of one hundred species have been described from the African continent alone, besides others in Central America, the West Indies, Southern Asia, and elsewhere. The genus is a very well-marked one, but the specific characters, as is natural when the number of closely related species is so large, are very minute. I have not, however, been able to identify the species with any of the previously described African forms; and, as the localities where it was collected are in a comparatively unexplored region, the presumption that this is a new form is not so rash as it might at first sight seem to be.

The worm is said by Dr. Christy to be very common and widely distributed in the region explored by him, *i. e.*, the

Ituri Forest district, between the rivers Welle and Aruwimi. The particular localities mentioned for the syntypes are Medje and Fundi.

I am indebted to Dr. Christy for some most interesting notes on the habits of these worms, from which I take the liberty of quoting some passages. With regard to their habitat and mode of life, he says:—"The worms are found, I think, all through the Ituri forest region, in wet forest. They go down several feet in the red clay, and it requires a lot of digging to get them. It is a common sight . . . to see their red clay 'chimneys' [casts] sticking up amongst the dead leaves. These are sometimes 4 or 5 inches high, and about 1½ inches in diameter: usually open at the top, but sometimes closed and rounded off . . . I have seen miners at the Bahayru mines using them as tobacco-pipes after baking them in the fire."

When irritated, the worms have the habit, like some other large earthworms, of squirting fluid from the dorsal pores to a considerable distance. The natives avoid touching them on this account, probably thinking them to be poisonous *. With regard to this habit, I again quote Dr. Christy's notes:—"Their squirting propensities only come into play under provocation. Many times I had picked them up with the fingers—which is not easy—before I discovered the habit. Only when I used the rat-tongs did I find out what they could do. The little jets of milky or opalescent and somewhat viscid fluid come simultaneously from all the pores [along each side of the body], and, to be on the safe side, are 10 or 12 inches high, but I think higher. The animal can make a second discharge some minutes later, or even a third." The words in square brackets in this passage are Dr. Christy's, but I think he must have been under a false impression with regard to the pores being on the sides of the body. I cannot find any pores there from which the fluid could have been squirted, and am of the opinion that it must come from the dorsal pores, which are large and conspicuous. With a struggling worm held in the forceps it would be difficult to see exactly where the jets of fluid originated.

On Dr. Christy's suggestion that the specific name should have reference to this power of squirting, I propose to call the new species *Dichogaster jaculatrix*.

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* A reference to the effectiveness of the same protective habit in another (unidentified) earthworm in Sierra Leone will be found in my paper on *Aspidodrilus* (Ann. & Mag. Nat. Hist. (8) xiv. 1914, p. 146).

Dichogaster jaculatrix, sp. n.*

EXTERNAL FEATURES.

The specimens vary in length between 18 and 34 cm., and have a diameter of about 10 mm. The number of segments is about 180.

The colour during life, according to Dr. Christy, was a "greenish blue." The cuticle of the specimens in spirit still shows a beautiful green and blue iridescence, the colours being remarkably intense and brilliant. Beneath the cuticle each segment is marked, on the dorsal side, with a purplish transverse band.

The prostomium is small, entering into a slight notch in the anterior border of the first segment. Often, however, it is completely withdrawn into the buccal cavity.

The clitellum commences on segment xiii., and extends back to segment xxii. or xxiii. The "genital area" on the ventral side of the clitellar region is roughly hourglass-shaped in outline, and usually rather deeply sunk. It occupies segments xvii.–xix. The pores of the spermiducal ("prostate") glands are arranged in two pairs, a pair near either end of the genital depression, on segments xvii. and xix. respectively, as is usually the case in this genus. The position of each of these pores is indicated by a single large penial seta, which projects from the body-wall in a very conspicuous manner. These penial setæ (fig. 1) measure 5 mm. in length and 0.13 mm. in thickness. They are entirely smooth, without ornamentation of any kind, and diminish rather suddenly at the tip, which is very slightly hooked.

The male pores lie on segment xviii., between the two apertures of the spermiducal glands on either side. The "seminal gutters," which connect the three pores on either side, are curved inwards towards the middle line, so as to approach each other more closely in the middle than at the ends. No genital papillæ have been observed.

The oviducal pores are quite easily seen on the ventral surface of segment xiv. They are situated rather near the middle line.

The ordinary chætæ (fig. 2) are very small for the size of the worm. The minute size of the chætæ, however, is a feature of almost universal occurrence in the genus. They are, as usual, arranged in four pairs on each segment, beginning with segment iii. They measure 0.8 mm. in length and 0·045 mm. in thickness. The portion distal to the nodular thickening is much shorter than the proximal portion, and only a very short piece projects beyond the body-wall.

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* A specific diagnosis is given on p. 457.

The dorsal pores invariably begin at v./vi. The continuity of the series is always broken by the absence of one or more of the pores in front of the clitellum, as has been remarked in the closely allied forms *D. moorei* and *D. johnstoni* *. The pore at xi./xii. seems to be invariably absent, while of those at x./xi. and at xii./xiii. one or both may also be missing.

Fig. 1.

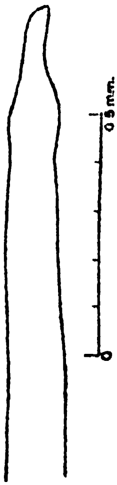

Fig. 2.

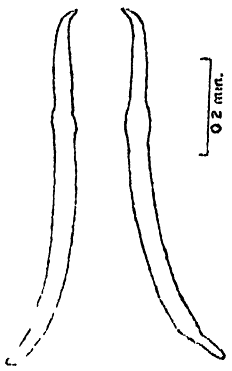

Fig. 1.—*Dichogaster jaculatrix.* Distal end of one of the penial setæ.
Fig. 2.—Ditto. Two ordinary chætæ.

There is little doubt of the normal absence of these pores, as the remainder are, in nearly all cases, well-expanded and easily visible. The pore at xiii./xiv. is sometimes visible, but the rest of the pores belonging to the segments of the clitellum, if present, are greatly obscured, until near the hinder end of the thickened epithelium. From xxi./xxii. or xxii./xxiii. onwards there is a continuous series of pores.

The apertures of the two pairs of spermathecæ occupy their usual positions at vii./viii. and viii./ix., near the mid-ventral line.

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* Beddard, Proc. Zool. Soc. 1901, ii. pp. 192, 199.

INTERNAL ANATOMY.

In the arrangement of the internal organs of this species there is little that calls for special notice. It agrees closely in almost all points with that usual in the genus.

Some of the anterior septa are wanting, as in other species; judging from the external segmentation, the missing ones are vi./vii.–viii./ix. The septa anterior to vi./vii. are represented only by muscle-strands connecting the alimentary canal with the body-wall. The first true septum, recognizable as such, is apparently ix./x. This absence of septa makes it difficult to decide to which segments the gizzards and other organs belong. The septa ix./x and x./xi. are pushed back considerably by the second gizzard, and both join the alimentary canal close together behind it. The two gizzards are not very distinct externally, but the separate muscular thickenings of their walls are easily seen on cutting them open.

There are three pairs of calciferous glands, situated, as usual, in xv.–xvii. The last pair is the largest, and the first the smallest. The glands of the first pair are sometimes of a much whiter appearance than the others, probably owing to the much greater quantity of calcareous crystals contained in them. The ducts of the glands open separately into the alimentary canal.

There is a single dorsal blood-vessel. The last pair of hearts is situated in segment xii.

Concerning the excretory system it is advisable to speak with some reserve. It is probable, however, that, with material specially preserved for histological investigation, the nephridia of this species would prove highly interesting. For the present it will be sufficient to indicate their peculiar arrangement. In the anterior half or two-thirds of the body there is in each segment, midway between the septa which limit it before and behind, a slight transverse mesentery, which seems to run completely round the inside of the body-wall, save for its interruption in the mid-ventral line by the nerve-cord and a slight gap on the dorsal side. On either side of this mesentery there is a series of small, whitish, flattened lobes, each of which may be regarded either as a separate nephridial organ or as a branch of a large compound nephridium. There is a tuft of such lobes, smaller than the rest, near the mid-ventral line on either side. These lobes are connected with a narrow duct which runs, in the thickness of the mesentery, round the segment.

Whether it is continuous all the way round, I am unable to state. This duct, which appears to be ciliated, gives off numerous other very fine, ciliated ducts, at right angles to itself, which pass towards the periphery. In transverse sections through the body-wall very delicate tubes, in whose walls no cellular structure has been detected, can be seen passing out between the bundles of longitudinal and circular muscles to the exterior. I have not succeeded in establishing their connection definitely with the ciliated tubes above mentioned, though it seems probable that such connection exists. The ciliated tubes in the mesentery were visible in whole preparations of nephridia, which were removed together with the mesentery, and mounted in glycerine. The distal ends of the tubes, where they pass between the muscles of the body-wall, could, of course, only be seen by the section method.

These tubes in the body-wall are generally accompanied by fine blood-vessels, while the mesentery is also well supplied with blood-vessels, sending branches to the nephridial lobes.

In the more anterior segments (*i. e.*, in segments a short distance behind the clitellum) I have not succeeded in finding any trace of ciliated nephridial funnels, or any other kind of internal nephridial opening, in spite of the examination of several whole preparations and a considerable number of sections. In the more posterior segments, however, *i. e.*, in about the last third of the body, such funnels certainly exist. In each segment in this region there is, near the ventral nerve-cord, a single pair of nephridial lobes of a much larger size than the rest, and each of these organs has a duct which perforates the septum in front and ends in a well-developed funnel in the preceding segment. In other respects, the arrangement of the nephridia appears to be the same as in the more anterior region.

The external nephridial pores are exceedingly difficult to detect, even in sections, being, apparently, the narrowest of passages between the cells of the epidermis. In spite of careful examination under a comparatively high power, I have been unable to recognize the pores in pieces of stripped-off cuticle, even when taken from the posterior region, where the internal funnels are undoubtedly present. There is a series of minute lozenge-shaped "impressions" in the cuticle, arranged in a single row round each segment, in a line with the little tubular invaginations surrounding the chætæ. These, however, are not pores, but are probably to be compared with the markings said to be the impressions of groups of sense-cells, and figured by Vejdovsky * in the case of his "*Dendrobæna rubida.*"

The "nephridial lobes," to which reference has already been made, consist of loops of the ciliated nephridial ducts and their accompanying blood-vessels, surrounded by a loose spongy mass of glandular cells, among which are scattered, usually in clumps, numerous small globules of some yellowish-brown substance. They thus seem, on the whole, to resemble the "tufts" of tubules, surrounded by aggregations of peritoneal cells, described by Beddard † in the allied form *Dichogaster damonis.*

It will be seen from the foregoing account that the nephridia in this species, though clearly to be included in the category of "diffuse" nephridia, are arranged on a plan which differs somewhat from the usual type. The appearance of pairing in the nephridial organs of each segment may, of course, be secondary, but it is suggestive of an intermediate condition between the strictly paired and the irregularly diffuse types of excretory system. There may be a network of tubules connecting the nephridia of successive segments, but, so far as my observations have gone, it seems more probable that each segment has its nephridial organs distinct from those of its neighbours.

Genital Organs.—The sperm-sacs consist of two pairs of dorsal prolongations, united by a median ventral space, in segments xi.–xii. The two pairs of testes and the two pairs of voluminous sperm-funnels occupy their usual positions in these segments. The sperm-ducts run for the greater part of their length in the thickness of the body-wall. The ovaries are in segment xiii.

The spermiducal or "prostate" glands are arranged in two pairs. They are large, massive, and solid organs, each consisting, apparently, of a single tube much coiled, and covered by a coat of peritoneum, so that the coils are not visible externally. Each gland gives off a narrow duct which opens close to the penial seta. The epithelium of the glands consists, as in other members of the family, of several layers of flask-shaped cells with very long ducts. The outermost cells are often grouped together in bunches.

There are two pairs of large spermathecæ in the usual position. These organs (figs. 3 & 4) have a stout muscular duct (*D.*) and a sac which is divided by a narrow passage into two chambers, of which the inner, blind, chamber (figs. 3 & 4, *2*) is the larger, and has comparatively thin and little-folded walls. Near the commencement of the duct there are visible, on the outside of the anterior and outer wall of the spermatheca, from one to three small sessile diverticula (figs. 3 & 4, *Div.*), which are found to contain sperm.

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* Syst. u. Morph. d. Oligochæten, 1884, pl. xv. fig. 13 *a.*

† Quart. Journ. Micr. Sci. n. ser., xxix. 1889, p. 259.

Fig. 3.

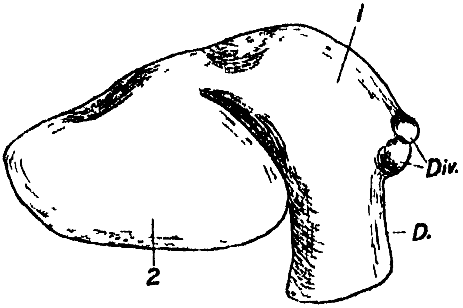

Fig. 4.

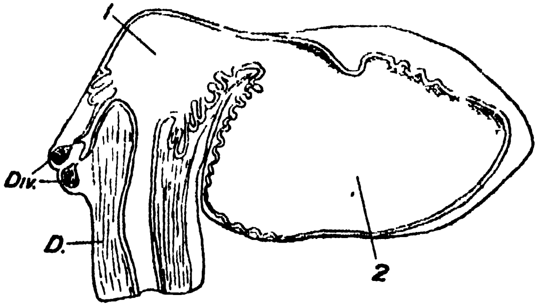

Fig. 3.—*Dichogaster jaculatrix.* The right spermatheca of the posterior pair, viewed from the right side. *D.*, the muscular duct: *Div.*, sperm-containing diverticula; *1*, middle chamber; *2*, terminal sac.

Fig. 4.—Ditto. View of the inside of one-half of a spermatheca, which has been longitudinally divided. The spermatophores, complete and in process of formation, have been removed. *D.*, the muscular duct; *Div.*, sperm-containing diverticula; *1*, middle chamber in which the upper capsule of the completed spermatophore lay; *2*, terminal blind sac.

The following is an attempt to summarize, in the form of a brief diagnosis, the chief characteristics of the species:—

Dichogaster jaculatrix, sp. n.

Length (in spirit) 18–34 cm.; thickness 10 mm.; number of segments about 180. *Colour iridescent greenish blue, with a purplish transverse band on each segment dorsally. Prostomium enters slightly into peristomium. Clitellum xiii.–xxii. (xxiii.). Genital area hourglass-shaped, xvii.–xix. Penial setæ smooth, straight, tip narrower and slightly hooked, without ornamentation. Seminal gutters convex inwardly. No genital papillæ. Dorsal pores begin at v./vi. Pores (x./xi.), xi./xii., (xii./xiii.) missing. Septa vi./vii.–viii./ix. absent. Nephridia in the form of a double series of lobes in each segment, supported by a transverse mesentery. Funnels present only in posterior segments. Spermathecæ with* 1–3 *small sessile diverticula visible externally. Spermatophores of characteristic form usually present in spermathecæ.*

Hab. Ituri Forest, Belgian Congo; in wet forest districts, among dead leaves.

Note on the Spermathecæ and Spermatophores.

The spermathecæ and their contents in this worm are of peculiar interest, and give rise to questions of a very puzzling nature.

In some other species of *Dichogaster* certain objects have been seen in the spermathecæ by the describers, which have been regarded by them as spermatophores. Our present knowledge of them is mainly due to the researches of Beddard, who has mentioned them in his descriptions of *D.* (*Benhamia*) *moorei** and *D. austeni*†, and has also devoted a special paper‡ to the discussion of those seen in the latter species. Michaelsen had also, previously to Beddard's memoir, made a brief reference to structures of a similar kind in *D.* (*Benhamia*) *monticola* and *D. itoliensis* §.

Of these various instances, the structures described by Beddard for *D. austeni* are certainly the most similar to those which I have observed in the present species.

Besides those of *Dichogaster*, the spermatophores of some other genera of earthworms are also of a more or less similar form; I may mention, for example, those of *Stuhlmannia* *, of *Polytoreutus kenyaensis* and *magilensis* †, *Pheretima* ‡, and more especially *Pareudrilus* §.

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* P. Z. S. 1901, ii. p. 107.

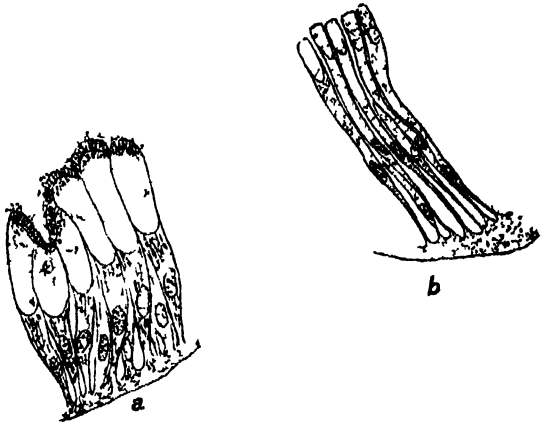
† *T. c.* p. 209.

‡ *T. c.* p. 704.

§ "Die Regenwurmer Ost-Afrikas," in 'Deutsch-Ost-Afrika,' pp. 27 & 28.

The spermatheca (figs. 3 & 4) of *D. jaculatrix* consists, as is usually the case, of a thick-walled muscular duct (*D.*), a middle chamber (*1*) with walls of medium thickness, and a large blind terminal chamber (*2*) with comparatively thin and little-folded walls. The walls of the middle chamber are thrown into numerous deep folds and pockets, and the whole organ, including the terminal pouch and the duct

Fig. 5.



Dichogaster jaculatrix. Portions of the epithelium from the inside of the spermatheca: *a*, from the terminal sac; *b*, from the middle chamber. (Cam., oil-imm. $\frac{1}{12}$, oc. 2 Zeiss.)

itself, is lined with an epithelium consisting of tall goblet-shaped glandular cells, which appear to have been in a state of somewhat active secretion.

There are certain differences in the form of these cells in different parts of the organ, probably corresponding to differences in function. The cells lining the terminal chamber (fig. 5, *a*) are tall, but not very narrow, and each has a long goblet-like cavity filled with granular secreted matter. The actual distal end of the cell appears to be capped by a thick membrane pierced with perforations. The large nucleus is situated near the stalk-end of the cell. In the middle chamber the cells (fig. 5, *b*) are much taller and narrower, and have a very short "cup" at the free end, a much narrower stalk, and a smaller nucleus, situated further from the basement-membrane.

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* See Beddard, P. Z. S. 1901, i. p. 344, and text-fig. 86.

† *Id.* P. Z. S. 1902, ii. p. 200, and text-figs. 52–54.

‡ *Id.* P. Z. S. 1911, p. 412.

§ *Id.* P. Z. S. 1903, i. p. 210.

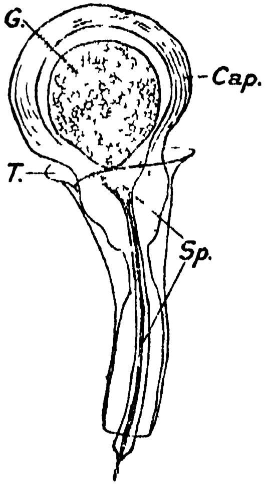
The sperm-containing diverticula (figs. 3 & 4, *Div.*), varying in number from one to three, which project on the anterior and outer surface of the organ, open into the cavity of the middle chamber by a narrow passage a little above its junction with the muscular duct. When more than one of these diverticula or pockets are present, their ducts appear to unite into a single canal of small calibre. There is a muscular coat external to the epithelium lining the pockets, which probably serves for the expulsion of the sperm at the appropriate moment.

The pockets and their ducts, like the rest of the spermatheca, are lined with a glandular epithelium, the cells of which are similar to those of the middle chamber, but smaller. The contained sperm is massed together into a solid ball—so much so that, on teasing out the mass of sperm from the pocket, I at first imagined that it was enclosed in a membrane. On the examination of sections, however, this does not appear to be the case. It is probable that the spermatozoa were swimming in a fluid medium, which has become solid as the result of preservation. Possibly it is the function of the cells of the epithelium to produce a special fluid for the nutriment of the spermatozoa during their retention in the pocket. If they were "glued" together, in the manner described, during life, it is difficult to understand how they could ever escape from the pockets again, since the way of egress is so narrow.

The muscular duct of the spermatheca seems invariably to contain a tough cuticular lining of peculiar shape. This is, in fact, the lower, trumpet-shaped portion (fig. 6, *T.*) of the "spermatophore," and is almost exactly like that described by Beddard in the case of *D. austeni.* To the more detailed study of this portion of the apparatus I shall return later. The upper part of the spermatophore consists of a spherical capsule (fig. 6, *Cap.*) of a fibrous or parchment-like consistency, which when fully developed occupies the middle chamber of the spermatheca, and fits into the trumpet-shaped upper end of the cuticular tube. This capsule and the trumpet-shaped tube together make up the complete "spermatophore."

The wall of the upper capsule is composed of numerous layers of some substance which is apparently non-cellular and structureless, but stains deeply with eosin. It is somewhat opaque, and of a tough consistency, but becomes softened in caustic potash; hence, it seems to me, there is reason to think that it is not chitinous. The contents of this upper portion of the spermatophore consist mainly of a spherical mass (fig. 6, *G.*) of a peculiar refractive substance, which, in the spirit-specimens at least, is extremely hard and brittle. It is composed of numerous granular masses closely pressed together, which can, however, without much difficulty be separated. In general appearance the substance of this mass is not unlike the yolk of an egg. Its separable block-like constituents may have been formed as fluid or semifluid globules, and have assumed their present irregular shapes under pressure, the whole mass having become hard and solid as the result of fixation.

Fig. 6.



A complete spermatophore, viewed as a transparent object. *Cap*, upper capsule; *G.*, solid mass of granular substance; *Sp.*, spermatozoa contained in lumen of lower portion; *T.*, rim of trumpet-shaped tube.

In the case of *D. austeni* Beddard has described a very similar spherical capsule, the wall of which is supposed to be chitinous and to be secreted by the columnar cells in the blind terminal sac of the spermatheca. But this capsule is said to be full of sperm, and there is no reference to the presence of a hard mass of non-cellular substance in it. In *Polytoreutus kenyaensis*, however, the same author describes * the acorn-shaped spermatophores as containing a solid mass of non-staining granular substance, in which are embedded numerous "sperm-ropes," or bundles of spermatozoa (which have themselves been called "spermatophores" in other species). The nature of the solid matrix, the author considers, is "probably identical with that of the substance forming the walls of the spermatophore," and he arrives at the conclusion that this substance is formed by the breaking-down of cells which wander away from the lining of the spermathecal sac.

In *Pheretima* the upper and larger end of the pear-shaped spermatophore is said † to be filled with a granular mass, probably composed of broken-down cells, and the sperm contained in the narrower portion is said to be separated from it by a delicate membrane. In attempting to interpret the functions of the granular mass, the author says that its "position . . . at the apex of the spermatophore suggests that it may be of mechanical assistance in expelling the sperm . . . Furthermore, if the case be watertight, the presence of this possibly largely fluid mass may be advantageous to the spermatozoa . . . Its function may be to keep the sperm moist and active." In any case, it seems clear, as the author says, that the granular substance plays some important part in the processes leading to fertilization.

The lower, trumpet-shaped tube of the spermatophore is in intimate connection with the epithelial lining of the duct of the spermatheca, and there seems to be no reasonable doubt that it is formed by the activity of this epithelium, and not out of material introduced from another worm. In *D. austeni* ‡ this portion of the spermatophore is described as having a structureless inner layer, and an outer layer "composed of a parallel series of oblong pieces closely adpressed," which are supposed to correspond to the individual cells of the epithelium. "When the spermatophore is viewed from the outside, these brick-like constituents form a kind of mosaic upon its surface." In *D. jaculatrix* this mosaic-like appearance is also seen, but the "brick-like constituents" in this case appear granular, and they are, I believe, of a different nature. In sections through the duct of the spermatheca, the trumpet-like tube is seen to consist of a non-staining, clear, structureless substance, in close contact with the tall columnar cells lining the spermathecal duct. Into its outer portion each of these cells sends a finger-like or clavate protoplasmic process (fig. 7, *Pr.*). Beyond this process there are sometimes visible traces of a cavity in the matrix, from which the process has evidently just been withdrawn, and which is doubtless filled with secreted matter which has not yet become solidly fused with the rest of the wall of the tube. When the spermatophore is dissected out from the spermathecal duct, and the epithelium of the latter teased off with needles (an operation which it is not easy to perform completely, owing to its very close adherence), some of the protoplasmic processes are torn out, but the majority of them are broken off from their cells and remain embedded in the matrix of secreted matter. It is these processes, I believe, which give the wall of the spermatophore its mosaic-like appearance when viewed from the outside. Beddard considered that this tube was probably of chitinous nature; but, owing to its being considerably softened and altered by caustic potash, I am inclined to think it is of a less hard material.

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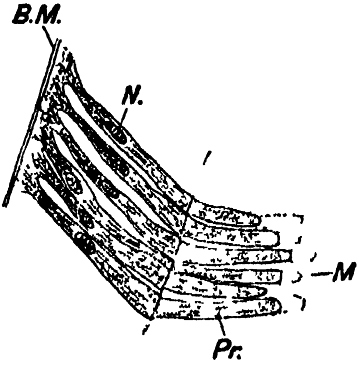
* P. Z. S. 1902, ii. p. 200.

† Beddard, P. Z. S. 1911, p. 419.

‡ P. Z. S. 1901, ii. p. 706.

Fig. 7.



Portion of the lining epithelium of the duct of the spermatheca. *B.M.*, basement-membrane; *M.*, secreted matrix (wall of trumpet-shaped tube); *N.*, nucleus; *Pr.*, protoplasmic processes secreting the substance of the tube. (Cam., oil-imm. $\frac{1}{12}$", oc. 2 Zeiss.)

The trumpet-like tube is filled with slightly eosinophilous matter of a yellow colour and a stratified appearance, down the centre of which there is a very narrow lumen, containing sperm (fig. 6, *Sp.*). This lumen is, I think, open at its lower extremity. The yellow matter and sperm were present in the spermatheca of which serial sections were cut, although no upper capsule was found in the middle spermathecal sac. The outer extremity of the trumpet like tube was also blocked by a mass of homogeneous substance, having much the appearance of yolk. This substance differs somewhat, however, from that of the mass contained in the upper capsule, when this is present, for the latter is much more granular.

In a spermatophore both parts of which, *i. e.*, both the trumpet-like tube and the upper capsule, were fully formed and in contact, the yellow stratified matter within the tube was found by the section method to be continuous with the wall of the upper capsule, but stained much less deeply. The sperm-containing lumen in this yellow matter was also in communication with the cavity of the capsule, the lower part of which also contained a small quantity of sperm, clinging to its walls.

It will probably be impossible to arrive at any definite conclusions regarding the history and ultimate fate of the "spermatophores" in these worms, until some good observer furnishes us with an account of their breeding-habits. Viewed from a structural standpoint, the spermatophores, if such they are, are most interesting and puzzling. It is very difficult to understand what can be the advantage of enclosing the sperm in such an elaborately-formed case, and not less so to trace the probable manner of its formation.

The only point which appears to me to be now settled almost with certainty, is that the lower, trumpet-like tube of the spermatophore is actually *secreted*, and not merely *moulded*, by the epithelium of the spermathecal duct. Beddard has already reached the conclusion that in *D. austeni* it is moulded at least, if not really secreted, by this duct, but with the reservation that the material might have been derived from the spermiducal glands of another worm. The evidence, in the present case, of the protoplasmic processes of the cells of the duct, extending as they do into the edges of the secreted matter, seems to me to place this question, with regard to *D. jaculatrix* at least, almost beyond doubt.

The origin of the other parts of the spermatophore, and the order of formation of all the parts, are, however, still very doubtful. From the glandular nature of the cells lining both divisions of the spermathecal sac, it would seem almost certain that they must play some part in the formation of the apparatus. I am inclined to believe that they are concerned in the secretion of the substance which forms the wall of the upper capsule; but whether any of this substance is derived from the spermiducal glands of another worm during copulation, appears to me still open to question.

In the spermatheca which I have examined by means of serial sections, the terminal chamber contained two or three bodies of somewhat irregular shape, with thick, stratified, strongly eosinophilous walls, and with their cavities filled with more or less hard granular matter. In fact, there can be no doubt that these bodies correspond exactly with the part of the fully-formed spermatophore which I have called the "upper capsule." It is not easy, however, to account for the mass of granular matter within the capsule It appears to me not unlikely that this, if anything, is what is derived from the spermiducal glands, and that it is the substance which acts as a stimulus to the epithelial cells of the spermatheca, and causes them to throw out their secretion and so surround it with the successive layers of matter which form the capsule. This, however, is merely suggested as a possibility; it is not incompatible with the appearance of the granules or globules of secretion seen in the cells of the spermiducal gland and the granular residual matter also found in the terminal chamber of the spermatheca. In any case, it seems doubtful whether either the granular mass or the capsule can be derived from broken-down epithelial cells of the spermatheca, since I have been unable to find any cells, recognizable as such, which had wandered off into the cavity of the sac.

Probably the formation of the capsule is not completed until it has been transferred from the terminal chamber into the middle chamber of the spermatheca Here, it may be supposed, the yellow stratified matter is formed, which lines the trumpet-shaped tube, and the lower end of the capsule is fused with this. How the spermatozoa are introduced into the apparatus is very doubtful. It may be that just before the fusion of the two portions a contraction of the sperm-diverticula, or of one of them, takes place, by means of the muscles of their walls, and the sperm is driven down the duct and into the required position near the mouth of the trumpet-shaped tube, whence it finds its way into the spermatophore.

Finally, the mass of homogeneous substance blocking the outer end of the spermathecal duct has to be accounted for. It seems to me probable, though by no means certain, that this is a plug formed by the coagulation of some secretion, after the act of copulation is complete. Beddard has suggested in the case of *Stuhlmannia* [*] that the thickened plug-like end of the spermatophore is derived from the spermiducal glands of the other worm. I think that in the present case a similar explanation may be applicable, and that this substance may be either a product of the spermiducal glands or a mucoid secretion of the skin of the clitellar region, and that it may serve a useful purpose in retaining the recently-injected sperm within the spermatheca, until it is stored in the special pockets provided for it, and also as a plug for the completed spermatophore.

My thanks are due to my friend and colleague, Dr. W. T. Calman, for some useful suggestions and criticisms while working at the subject of this paper.

LVI.—*List of Mammals (exclusive of Ungulata) collected on the Upper Congo by Dr. Christy for the Congo Museum, Tervueren.* By OLDFIELD THOMAS, F.R.S.

(Published by permission of the Trustees of the British Museum.)

IN the 'Annals' for last August [†] I published a few of the more striking novelties from the fine series of Mammalia brought home from the Congo by Dr. Cuthbert Christy, who had been employed by the Congo Museum to make a collection for them on the Ituri and Welle, and, by request of the Belgian authorities, I now give a list of all the species obtained by him, with the exception of the Ungulates.

Such a list is always valuable for zoo-geographical reasons, and Dr. Christy's fine collection so supplements those made in the same region by Emin Pasha, the Alexander-Gosling Expedition, and the members of the Ruwenzori Expedition, as to make the complete list a very long one.

In a general way, there is a great uniformity in the Mammal life from the Cameroons to Uganda, as might be expected from the uniform nature of the country, but in a few cases there is enough local difference to authorise the distinction of special subspecies for the Upper Congo forms.

In all, Dr. Christy's collection contains 74 species and subspecies, of which 10 have proved to need description as new. Five of these were described in the previous paper.

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[*] P. Z. S. 1901, i. p. 351.

[†] Ann. & Mag. N. H. (8) xvi. p. 146 (1915).

Dr. Christy's numbers run up to 1530, but the present account only deals with the later two-thirds of the collection, the earlier series having either been already named by Mr. Dollman or else gone elsewhere for determination.

The great majority of the mammals here referred to were obtained at two localities, Medje, on a branch of the Ituri, about 27° 40′ E., 2° 20′ N., and Poko, some 20 or 30 miles north-west of it, but across the watershed in the Welle basin. The latter is not very far from Emin's locality, Tingasi. The other localities mentioned are mostly in the Aruwimi-Ituri basin.

By the generosity of the authorities at Tervueren, the British Museum has been allowed to retain examples of nearly all the species obtained, including all those described as new. In particular, we have to thank Dr. Schouteden for his kindness both in placing the collection in our hands for determination and for the liberality with which we have been allowed to select duplicates. The sum of these latter forms a very valuable donation to the British Museum.

In normal times this list would have been prepared by Mr. Dollman in continuation of the paper he published in the Tervuéren Journal in 1914 *, but he has gone to serve his country, and it is quite impossible for publication to take place in Belgium. With the consent of the Belgian authorities the paper is therefore prepared by me and published in the 'Annals.'

1. *Colobus cottoni*, Lyd.

1219 (young). Poko.

2. *Cercopithecus schmidti*, Matsch.

716, 755. Medje.
900, 1008, 1164, 1165, 1352, 1353. Poko.

3. *Cercopithecus neglectus*, Schl.

1168. Poko.

4. *Hemigalago demidoffi medius*, subsp. n.

737, 750. Medje.
979, 994, 1091, 1214, 1247, 1292, 1359, 1388, 1390, 1397, Poko.

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* Rev. Zool Afr. iv p. 75 (1914)

Coloration and general characters as in true *demidoffi*, but skull averaging larger.

Size distinctly larger than in *demidoffi*, smaller than in the Ruwenzori and Uganda *thomasi*. General colour above near Prout's brown, but very variable, rarely so bright as in *demidoffi* or so dull as in *thomasi*, but the series shows all stages between the two. Under surface always washed with yellowish, not more or less white as in *poensis*.

Skull larger than in *demidoffi*, about equalling that of *poensis*, smaller than in *thomasi*.

Dimensions of no. 1214, the type, ♂ (taken on the skin):—

Head and body 150 mm.; tail 193; hind foot 50.

Skull: greatest length (occiput to gnathion) 39·3; occiput to tip of nasals 39·3; basal length 31·2; zygomatic breadth 24·3; breadth of brain-case above meatus 20; front of canine to back of m^3 13.

Ordinary mainland western specimens have a greatest skull-length of about 36 to 38 mm., these middle-area examples, as also those from Fernando Po (subsp. *poensis*) about 38–40, while in the Ruwenzori *thomasi* this measurement is 41–42 mm., the general size of the skull varying in proportion.

With regard to Pousargues's *Galago* (*Hemigalago*) *anomurus*, from the Ubanghi, the colour as described and figured and the short tail are so different from what is found in any form of the present series, that it is evidently a wholly distinct animal. If by any chance the original skulls, whose measurements nearly agree with those of *H. d. medius*, should prove not to belong to the skins described, the latter would clearly have to be taken as typical, as their characters are those on which the species is mainly founded.

Specimens of this new form were obtained by Emin Pasha in 1884 and the Alexander-Gosling Expedition in 1905–6.

5. *Perodicticus faustus*, Thos.

850. Medje.

893, 957, 958, 1102, 1284, 1293, 1309, 1496. Poko.

6. *Eidolon helvum*, Kerr.

889. Medje.

7. *Epomops franqueti franqueti*, Tomes.

860, 883. Medje, Ituri.

8. *Hipposideros caffer*, Sund.

996, 997, 1078, 1251, 1252, 1296–1300. Poko, Welle.

9. *Nycteris grandis*, Pet.

1351. Poko.

10. *Nycteris hispida*, Schr.

818. Medje.
1311, 1372, 1401. Poko.

11. *Scotophilus nux*, Thos.

739, 740. Medje.

The conspicuous difference between the colour of *S. nux* and that of all forms of *S. nigrita* makes me now think that it should be recognized as a distinct species, and not merely a subspecies of the older known form.

These specimens show no difference from the type, which was collected by Mr. Bates at Efulen, Cameroons.

12. *Otomops martiensseni*, Matsch.

1290. Poko.

Only hitherto known by the type in the Berlin Museum.

As I expected when describing *O. wroughtoni*, this African *Otomops* is quite remarkably similar to its Indian relative. All the important skull-characters marking the genus *Otomops* are quite the same, even to the peculiar vertical plate on the zygomata.

In colour, however, there is quite sufficient difference to leave no doubt that the two forms are specifically distinct.

[Although not a part of the Christy collection, the following interesting bat, being from the same region of the Congo, may be here described. Most unfortunately, it is without the skull, but the structure of its ears and muzzle leave me in little doubt as to its affinities.

These would appear to be with the bat hitherto known as *Eomops whitleyi*, but Mr. Miller has made out so strong a case for the generic identity of *Eomops* with the far earlier *Myopterus*, Geoff., that I am prepared to accept it until such time as the capture in Senegal of a bat corresponding with Daubenton's description confirms or upsets Mr. Miller's hypothesis.

It should, however, be noted that Gervais's figure of the skull shows no trace of the high and abrupt sagittal crest so well marked in *E. whitleyi*, and likely to be still more developed in a larger species of the same genus.

Myopterus albatus, sp. n.

A large whitish and white-winged species with the upper body-colour arranged in a lineated pattern.

Size large, the forearm about half as long again as in *M. whitleyi*, and rather larger than that of *M. daubentoni* would be if in the same relative proportion to the skull (that is to say, about twice the length) as in *M. whitleyi*. Fur soft and fine, hairs of shoulders about 4½ mm. in length, of lower back 3½. Fur not extending at all on the membranes, and stopping on the lower back a little way short of the tail, just as in *M. whitleyi*. General ground-colour above drabby brown ("dusky drab"), the hairs white at their bases, brown terminally; but on the median area of the nape, from occiput to withers, and along two broad lines running down the back on each side from the withers, the white extends nearly to the tips of the hairs, so as to show through above, and to form broad whitish lines, the brown along the side of the body and that in the middle line from the withers backwards, therefore, appearing as three broad brown longitudinal lines separated by whitish. Fur of whole of under surface pure creamy white, sharply contrasted on the sides of the neck with the brown of the upper surface. Wing-membranes white throughout, except that by the side of the body which is spotted with brown granules, just as in *M. whitleyi*; interfemoral membrane brown. Upper surface of forearms, digits, legs, and feet also brown.

Ears apparently similar in structure to those of *M. whitleyi*, separated in the middle line, their inner keels low and little developed. Tragus short and broad. Nasal septum without a mesial ridge, clothed with fine whitish hairs. Edges of lips with a close mixture of spoon-shaped and normal bristle-hairs. Lips practically without wrinkles. Wings to the distal end of the tibiæ.

Dimensions (measured on the skin):—

Forearm 55 mm.

Head and body (probably stretched) 84; tail 40; ear (dry) 19; third finger, metacarpal 54·5, first phalanx 19·5, second phalanx 19·5; fifth finger, metacarpal 35, first phalanx 15; hind foot (c. u.) 13.

Hab. R. Welle. Collected by M. Hutereau.

Original number 17. Congo Museum, no. 2911.

The coloration of this beautiful bat is quite unique, but of course it assimilates, in the brown upper and white lower surface, with that of *M. daubentoni* and *whitleyi*.]

13. *Rhynchocyon claudi*, Thos. & Wrought.

789. Medje.

984, 1020, 1021, 1189, 1198, 1199, 1209, 1216, 1227, 1232, 1377, 1409. Poko.

14. *Potamogale velox argens*, subsp. n.

763. Medje.

1206. Poko.

All essential characters as in true *P. velox* of the Lower Congo, Gaboon, &c., but the white of the underside more extended, reaching higher up on the sides, where also the brown hairs are prominently tipped with greyish white. Fore limbs whitish, almost wholly in the whitish area. Sides and under surface of hairy base of tail silvery white, nearly wholly brown in *velox*.

Hind foot of no. 763, the type, 40·5 mm.

Skull: condylo-basal length 66; upper tooth-series 32·3.

15. *Crocidura sururæ*, Hell.

890. Viadama, Welle.

949. Poko.

949 is quite like examples from Wadelai and others from the Alexander-Gosling Expedition determined by Mr. Dollman; 890 is rather darker.

16. *Crocidura poensis attila*, Dollm.

807, 812, 854, 858, 866, 873. Medje, Welle.

17. *Scutisorex congicus*, sp. n.

♂. 840. Medje, Upper Ituri, 17th April, 1914.

Skull smaller than in *S. somereni*, and colour more suffused with buffy.

General appearance and coloration quite as in *S. somereni*, except that the fur is more suffused with buffy or isabella, but even this difference is not unlikely to be individual or sexual. Fur slightly shorter and harsher than in the allied species.

Skull decidedly smaller than in *S. somereni*, the specimen being a male and that of *somereni* a female; the difference is greater than occurs within any of the series of African *Crocidurae* recently published by Mr. Dollman. Lambdoid crests not projecting backwards beyond the level of the condyles. Teeth essentially similar, but the last upper unicuspid rather smaller in proportion.

Dimensions (measured in flesh):—

Head and body 143 mm.; tail 77; hind foot 20; ear 10.

Skull: condylo-incisive length 31·3; condylo-basal length 30·2; greatest breadth 13·2; anterior breadth across palate 9·6; palatal length 14; upper tooth-row 13·6; tip of i^1 to tip of p^4 7·2; front of p^4 to back of m^3 6·4 (in *somereni* 7·5); lower tooth-row 12·7.

This shrew differs from its Uganda ally mainly by its smaller size and smaller teeth. The type of *S. somereni* was hitherto the only specimen of the genus known, so that this second example is of much value. The generic characters used to distinguish *Scutisorex* from *Sylvisorex*, in which *somereni* was first placed, are as marked in *S. congicus* as in the typical form, no approximation to *Sylvisorex* being perceptible.

18. *Sylvisorex morio*, Gray.

824 (immature). Medje, Ituri.

19. *Sylvisorex gemmeus irene*, Thos.

809. Medje.
1250. Poko.

This dark form was first obtained by Mr. Robin Kemp in Southern Uganda, but was only distinguished on the arrival of these specimens.

20. *Felis ocreata*, Gmel.

1205, 1440, 1504. Poko.

21. *Civettictis civetta*, L.

814. Medje.
1030, 1063, 1282, 1308, 1523, 1530. Poko.
No. 1530 the only adult, no. 1063 melanoid.

22. *Genetta victoriæ*, Thos.

642. Moera.
706. Mawambi.
1575. Peli-Peli, near Stanleyville.

23. *Genetta bettoni*, Thos.

655. Moera.
741. Medje.
1104, 1494. Poko.

24. *Genetta stuhlmanni*, Matsch.

742, 801, 888. Medje.
896, 1055, 1056, 1146, 1147, 1148, 1528. Poko.

25. *Nandinia binotata*, Gray.

745, 865. Medje.
986, 1025, 1054, 1190, 1203, 1204, 1289, 1525, 1529. Poko.

26. *Mungos paludinosus*, G. Cuv.

1166. Poko.

27. *Mungos albicauda*, Cuv.

894, 1202. Poko.

28. *Bdeogale nigripes*, Puch.

684. Zambo.

29. *Crossarchus alexandri*, Thos. & Wr.

504, 704. Mawambi.
643. Moera.
1316. Poko.

30. *Crossarchus gothneh*, Fitz.

917, 987, 1152, 1153. Poko.

31. *Anomalurus jacksoni*, Thos.

648. Moera, Beni
802, 813. Medje.
1133, 1222, 1361, 1362, 1389. Poko.

32. *Anomalurus pusillus*, Thos.

628. Moera, Beni.
747, 751, 822, 874. Medje.
1158, 1360, 1366, 1395, 1456, 1497, 1498. Poko.

33. *Protoxerus stangeri centricola*, Thos.

594, 624, 647. Moera.
660, 693. Alimasi.
707, 710. Mawambi.
892, 959, 1001, 1003, 1006, 1157, 1356, 1358, 1422, 1445, 1503, 1522, 1532. Poko.

34. *Heliosciurus rufobrachiatus pasha*, Schwann.

551. Irumu.
744, 746, 770, 810. Medje.
976, 1000, 1004, 1010, 1342, 1345, 1399, 1402, 1417. Poko.

35. *Paraxerus boehmi emini*, Matsch.

♂. 738, 808; ♀. 743, 795. Medje.
♂. 708, 709; ♀. 702 (young), 705. Mawambi.
♂. 931, 1074, 1151, 1218, 1286, 1291, 1306, 1307; ♀. 1271. Poko.

36. *Paraxerus alexandri*, Thos. & Wr.

♂. 754, 790, 833; ♀. 794. Medje.
♂. 1376. Poko.
Type-locality. Gudima, R. Iri, Upper Welle.

Like *P. boehmi*, this beautiful little squirrel has 1—2=6 mammæ.

37. *Funisciurus anerythrus*, Thos.

711. Mawambi.
726. Avakubi.
736, 764, 799, 805, 829, 853. Medje.
906, 908, 947, 954, 1007, 1024, 1035, 1228, 1236, 1255, 1263, 1283, 1315, 1404, 1419. Poko.

Correspond closely with the two original specimens obtained by Emin Pasha at Bugueira.

Examination of these fresh skins has enabled me to discriminate *F. a. bandarum*, the form found on the Upper Shari, which had hitherto been referred to *F. anerythrus*.

38. *Funisciurus akka*, de Wint.

766, 768, 846, 847. Medje.
961, 977, 1249, 1294, 1357, 1365, 1479. Poko.

The type of *F. akka* has more rufous legs than any specimen of this series; but a paratype, also from Tingasi, the type-locality, is quite similar to the average of the present set.

39. *Euxerus erythropus lacustris*, Thos.

895, 898, 899. Panga, Poko.
919, 978, 995, 1005, 1081, 1201, 1208, 1524. Poko.

40. *Graphiurus christyi*, Dollm.

803, 870. Medje.
1274. Poko.

41. *Graphiurus lorraineus*, Dollm.

1061, 1162. Poko.

The type of *G. lorraineus* was collected by Capt. Boyd Alexander near the junction of the Welle with the Ubanghi.

42. *Deomys christyi*, Thos.

T. c. p. 150

950, 968, 990, 1048, 1089, 1134, 1145, 1305. Poko, Welle.

A well-marked eastern representative of the *D. ferrugineus* of the Lower Congo, and one of the most striking new species discovered by Dr. Christy.

43. *Dendromus messorius*, Thos.

787, 804. Medje.
891. Viadana.
1239, 1286. Poko.

Quite similar both in skin and skull to typical examples from the Cameroons.

"Banana-mouse" (*Christy*).

44. *Tatera dichrura*, Thos.

T. c. p. 147

945, 955, 964, 969, 971, 975, 980, 1011, 1027, 1028, 1036, 1037, 1049, 1057, 1058, 1064, 1065, 1075, 1084, 1212, 1224, 1244, 1304, 1435, 1444, 1453, 1455, 1460, 1514, 1517, 1519. Poko, Welle.

A large species of the *T. liodon* group.

45. *Taterillus congicus*, Thos.

T. c. p. 147.

916, 918, 940, 993, 998, 1009, 1043, 1047, 1053, 1055, 1070, 1076, 1079, 1080, 1093, 1094, 1105, 1139, 1188, 1238, 1242, 1243, 1287, 1303, 1448, 1449, 1454. Poko.

46. *Cricetomys gambianus emini*, Wrought.

757, 758, 765, 769, 826. Medje.
960, 1059, 1060, 1062, 1103, 1141, 1220, 1314, 1393, 1403, 1492, 1493, 1512. Poko.

47. *Cricetomys gambianus dichrurus*, Osg.

897. Panga, Welle.

The close agreement of this specimen, as of the pair from the same region mentioned by Mr. Osgood, with the type of *dichrurus* is very marked.

Possibly this greyish form is really a race of *C. ansorgei*, but I provisionally accept Mr. Osgood's name for it.

48. *Lophuromys ansorgei*, de Wint.

861. Medje.
914, 920, 952, 1144, 1270, 1341, 1473, 1510. Poko.

Reddish below, as in Heller's "*L. pyrrhus*," but this is also the case in specimens from Mt. Elgon, near the type-locality of *ansorgei*.

49. *Lophuromys aquilus*, True.

755, 827, 868. Medje.
1320, 1333, 1368, 1400, 1474. Poko.

I provisionally put these specimens under the same name as that which Wroughton and I used in the Ruwenzori Report for the common speckled *Lophuromys*. A considerable number of names have, however, been added in this group, but the characters are so slight, and in every locality there is so great a range of variation both in colour and skull, that I think many of them will ultimately prove to be untenable.

50. *Colomys goslingi*, Thos. & Wrought.

876, 884, 885. Medje.
991, 1039, 1051, 1100, 1101, 1134, 1156, 1310, 1318. Poko.

This remarkable Murine, previously only known by the type collected by the late Capt. G. B. Gosling at Gambi on the Welle, attracted Dr. Christy's attention very much by its peculiar habits. He says that it lives constantly at the water's edge, where its elongated feet enable it to wade about on the stones, and that it feeds on small water crustaceans and insects, not on vegetable matter.

51. *Œnomys hypoxanthus*, Puch.

756, 760, 789, 806, 821, 841. Medjé.

1040, 1135, 1229, 1230, 1321, 1458, 1470, 1471, 1472. Poko.

The majority of the specimens agree absolutely with Cameroons and Gaboon examples of *hypoxanthus*, and have teeth of the same comparatively large size; but in some the teeth are rather smaller, and it is possible that these are referable to the Uganda *Œ. bacchante*. There is, however, so much variation, both in colour and skull-characters in this genus that it is not possible to identify every specimen satisfactorily without more material and prolonged study.

52. *Thamnomys rutilans centralis*, Dollm.

752, 762, 781, 782, 792, 834, 855, 856. Medje.

1041, 1067, 1071, 1087, 1106, 1130, 1132, 1350, 1372, 1374, 1375, 1378, 1380, 1383, 1386, 1387, 1391, 1392, 1411, 1412, 1413, 1481. Poko.

Although I use the above name as being unquestionably applicable to these specimens, there is so much variation among them in the size of the skull and teeth that they may possibly prove to grade into the earlier *Thamnomys kuru*, Thos. & Wr., whose distinction from *Th. rutilans* mainly consists in its smaller size. The type of *Th. kuru* was from Gambi, Mobatti country, and that of *centralis* from Fundi.

53. *Thamnomys venustus*, Thos.

♂. 830. Medje.

Only hitherto known from the type, which is slightly larger, but the difference does not exceed that found among the series of *Th. rutilans*. The long parallel-sided palatal foramina and the grey-based chest-hairs are very characteristic. *Th. kempi*, Dollm., also belongs to the same group.

54. *Grammomys macmillani*, Wrought.

1457. Poko.

55. *Malacomys centralis*, de Wint.

783, 786, 875, 877, 878. Medje.

951, 956, 962, 1015, 1019, 1068, 1072, 1086, 1107, 1128, 1238, 1319, 1334, 1335, 1337, 1338, 1339, 1379, 1381, 1382, 1383. Poko.

Type from Tingasi (*Emin Pasha*).

56. *Epimys* (*Æthomys*, subgen. nov.) *kaiseri*, Noack.

922, 932, 933, 934, 939, 948, 953, 965, 966, 967, 981, 982, 985, 992, 1016, 1022, 1029, 1042, 1045, 1052, 1083, 1096, 1108, 1109, 1137, 1187, 1197, 1215, 1217, 1246, 1257, 1425, 1427, 1436, 1441, 1442, 1446, 1447, 1451, 1459, 1520. Poko, Welle.

These may represent Heller's *E. k. centralis*, if really distinct from the older known forms.

In working out this series of African *Epimys*, I come, not for the first time, to the conclusion that the classification of these difficult animals would be advanced if certain of the "groups" were given subgeneric names. Detailed characters will need much further material and study, but the most obvious characters of the subgenera lying in their mammary formulæ, I may give the following preliminary synopsis:—

A. Mammæ less than 14, separated into pectoral and inguinal sets.	
a. Inguinal mammæ 3 pairs. Mammæ 2—3 or 3—3=10 or 12 ……..	*Epimys*, s. s.
b. Inguinal mammæ 2 pairs.	
a^2. Pectoral mammæ 2 pairs or less.	
a^3. Size large; form heavy; mammæ 0—2=4 or 1—2=6 ……………	*Æthomys* *, subg. n.
b^3. Size small; form delicate and mouse-like; mammæ 1—2=6 or 2—2=8 .	*Praomys*, subg. n.
b^2. Mammæ 3—2=10 ………………	*Myomys* †, subg. n.
B. Mammæ more than 14, in continuous series .	*Mastomys*, subg. n.

The type of *Æthomys* would be *Epimys hindei*, Thos., of *Praomys E. tullbergi*, Thos., of *Myomys E. colonus*, Smith, and of *Mastomys E. coucha*, Smith.

I hope to give later more detailed characters of these subgenera, with lists of the species that fall into them.

57. *Epimys* (*Æthomys*) *longicaudatus ituricus*, Thos.

T. c. p. 149.

759, 767, 848, 849, 857, 869. Medje.

970, 1013, 1017, 1031, 1129. Poko.

As already stated, this rat is distinguished from true *E. longicaudatus*, better known as *E. sebastianus*, by its greyish flanks and whitish lower side of tail.

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* From αἰθός, the basis of the word Ethiopian.

† Mammary formula the same as in true *Mus*.

58. *Epimys* (*Praomys*) *tullbergi*, Thos.

702. Mawambi.

748, 749, 791, 796, 811, 815, 820, 823, 825, 828, 837, 839, 862, 863, 882, 886. Medje.

937, 989, 1018, 1088, 1136, 1140, 1149, 1150, 1155, 1261, 1340, 1466, 1467, 1468, 1469. Poko.

59. *Epimys* (*Praomys*) *stella*, Thos.

752, 836, 845, 864, 871, 879, 880, 887. Medje, Ituri.

1127. Poko, Welle.

60. *Epimys* (*Mastomys*) *coucha*, Smith.

723. Bosabangi.

761. Medje.

904. Panga.

907, 942, 983, 1033, 1044, 1050, 1066, 1077, 1143, 1200, 1226, 1258, 1259, 1260, 1262, 1268, 1269, 1279, 1280, 1281, 1285, 1369, 1370, 1408, 1416, 1424, 1452, 1465, 1483–1490, 1513, 1516, 1518, 1521. Poko.

Common in houses of natives.

61. *Mus pasha*, Thos.

910. Panga, Welle.

909, 912, 936, 941, 973, 974, 1002, 1014, 1421. Poko.

This distinct species having been only hitherto known by the single imperfect specimen sent home by Emin Pasha, the present fine series is very acceptable.

I may note that by some accident the measurement of the upper molar series was given as 4 mm. in the original description. Its true measurement is 3·7 mm.

The dimensions of one of Dr. Christy's specimens are as follows:—

Head and body 75 mm.; tail 50; hind foot 15; ear 11.

Skull: greatest length 21·2; condylo-incisive length 20; upper molar series 3·7.

62. *Mus bellus*, Thos.

793, 803, 831, 852, 867, 881. Medje.

1023, 1480. Poko.

63. *Hybomys univittatus*, Pet.

725. Avakubi.
771, 835, 838. Medje.
913, 972, 1032, 1046, 1069, 1072. Poko.
As usual, very variable in size and colour.

64. *Mylomys alberti*, Thos.

T. c. p. 148.

♂. 1231; ♀. 1237. Poko, Welle.
A most handsome species. Named after His Majesty the King of the Belgians.
Owing to the original label having fallen off, the measurements in my description were taken from the skin. Now, however, the label has been found, and the flesh-measurements taken by Dr. Christy may be recorded as follows:—Head and body 180 mm.; tail 165; hind foot 36; ear 21.

65. *Arvicanthis striatus*, L.

724. Bosabangi.
905. Panga.
921, 938, 946, 1322, 1323, 1333, 1336, 1384, 1414, 1415, 1461, 1462, 1464, 1475, 1476, 1477, 1478, 1511. Poko.
Allowing for their variation in colour according to freshness of fur, there seems remarkably little difference between these specimens and the E.-African *A. massaicus*, on the one hand, and true W.-African *A. striatus*, including *A. pulchellus*, on the other.

66. *Arvicanthis micropus*, Hell.

911, 1463. Poko.
Described by Heller as a subspecies of *A. pulchellus*; but, as that species (i. e., *A. striatus*) is abundantly represented at Poko, this reference would seem to be incorrect. Intermediate in size between *A. striatus* and *A. macculus*.

67. *Arvicanthis macculus akka*, subsp. n.

943. Poko. (Type a specimen obtained by Emin Pasha.)
General characters as in true *macculus* of Ruwenzori and Uganda, but the general greyish colour strongly suffused with cinnamon and the intermediate dorsal light stripes much

less conspicuous. A well-marked buffy line over each eye. Crown grizzled greyish cinnamon. Ground-colour of back buffy or cinnamon greyish as compared with the clear greyish of true *macculus*.

Flesh-measurements of no. 943.

Head and body 100 mm.; tail 95; hind foot 21; ear 16.

Hind foot of type 20·5.

Skull: greatest length 27·5; condylo-incisive length 24·5; zygomatic breadth 12·3; breadth of brain-case 12; palatal foramina 5·5; upper molar series (crowns) 4·5.

Hab. Welle area. Type from Tingasi, Bomakandi River.

Type. Male. B.M. no. 87. 12. 1. 67. Collected 30th September, 1883, and presented by Emin Pasha.

Compared with seven specimens of *A. macculus* taken at different places and seasons, these Welle examples differ by their general cinnamon coloration. Dr. Christy's modern specimen is quite similar to that obtained by Emin Pasha in 1883 on the same affluent of the Welle.

68. *Dasymys bentleyæ*, Thos.

800. Medje, Ituri.

935, 999, 1012, 1038, 1092, 1125, 1126, 1127, 1213, 1235, 1245, 1255, 1256, 1301, 1302. Poko, Welle.

These specimens, taken as a series, are intermediate between *D. bentleyæ* of the Lower Congo and *D. medius* of Ruwenzori. The majority are as large as the latter (one or two are even larger), while, on the other hand, several are fully as small as the type of *D. bentleyæ* and have equally small bullæ. But in this latter character there is, as usual, considerable variability.

Swamp and river-side animals such as *Dasymys* are not very likely to have distinctive geographical races in so uniformly waterlogged a country as the Congo area.

69. *Zelotomys instans*, sp. n.

♀. 1026. Poko, Welle. 20th June, 1914.

A Congo representative of the East-African *Z. hildegardeæ*.

Size about as in *hildegardeæ*. Fur rather shorter and crisper. General colour above slaty greyish, without the drab suffusion characteristic of *hildegardeæ*. Median line blackish slaty, sides clearer greyish. Under surface slaty grey washed with whitish, the slaty bases of the hairs showing through. Cheeks and throat not so markedly white as in the allied species. Hands and feet white. Tail almost naked, finely speckled with brown as in the darker-tailed individuals of *Z. hildegardeæ*. Mammæ 3—2=10, as is also the case in *Z. hildegardeæ*.

Skull of about the same size as in *hildegardeæ*. Zygomata rather more widely and evenly spaced, their widest point opposite the posterior molars instead of further back. Bullæ slightly larger.

Incisors longer and more strongly thrown forward, the general line of the exposed portion directed forwards instead of being vertical. Molars decidedly larger and heavier.

Dimensions of the type (measured in the flesh):—

Head and body 133 mm.; tail 88; hind foot 22; ear 16.

Skull: greatest length (bone only) 30·8; condylo-incisive length (increased by forward direction of incisors) 31·2; zygomatic breadth 17·3; nasals 12; interorbital breadth 4·8; palatilar length 15; diastema 9; palatal foramina 7·4; upper molar series (crowns) 5·9.

This rat is readily distinguishable from its East-African ally, hitherto the only known species of the genus, by its greyer and less drabby colour, more projecting incisors, and larger molars.

70. *Thryonomys harrisoni*, Thos. & Wroughton.

1210, 1211, 1531. Poko.

71. *Atherurus centralis*, Thos.

1312, 1313, 1343, 1346, 1353, 1364, 1396, 1398, 1406, 1499, 1500. Poko.

72. *Manis gigantea*, Ill.

687. Zambo.

73. *Manis macroura*, Erxl.

(No number.) Poko.

74. *Manis tricuspis*, Raf.

713, 832, 843. Medje.
1142, 1207, 1443, 1495, 1501. Poko.

LVII.—*Descriptions and Records of Bees.*—LXX.

By T. D. A. COCKERELL, University of Colorado.

Melissodes robustior, sp. n.

♀.—Length about 13 mm., anterior wing 10 mm.

Robust, black, with the pubescence mainly light ochraceous, but a moderate amount of black on vertex; mesothorax with a large patch of black hair on disc posteriorly, not approaching sides; anterior part of scutellum with much black hair; tegulæ with light hair in front and black about middle; hair on apical part of anterior and middle tibiæ externally sooty; anterior and middle tarsi and inner side of hind tarsi with dark brown hair; scopa of hind legs very large, collecting a great amount of sunflower pollen; hind margins of abdominal segments dark, only the first narrowly subhyaline; abdominal bands very pale ochraceous, no well-defined basal band on second segment, and the middle one more or less interrupted in middle; fifth and sixth segments with black hair, fifth with long pale hair at sides; venter with reddish hair. Head broad, facial quadrangle broader than long; antennæ black, the flagellum marked with dull red beneath; tegulæ black or rufo-piceous. Wings dusky, nervures fuscous; disc of mesothorax shining, with distinct, well-separated punctures; spurs very pale yellowish.

♂.—Length about 11 mm., flagellum 7 mm.

Pubescence pale ochraceous, with a little black on disc of mesothorax and scutellum; mandibles black; labrum with a round cream-coloured spot; clypeus bright lemon-yellow; flagellum bright ferruginous beneath; third antennal joint longer than broad; tegulæ with ochreous hair. Wings dusky, nervures fuscous, the basal nervure ferruginous. Hind margins of abdominal segments broadly reddish subhyaline; hair on inner side of hind tarsi ferruginous.

Hab. Berkeley, California; females at flowers of cultivated *Helianthus annuus*, the type, Aug. 9, 1915. The male, which possibly represents a distinct species, was collected at Los Angeles, California, at flowers of *Helianthus lenticularis*, August 1915 (*Cockerell*). At Orange, California, Aug. 16, I found numerous *Melissodes* visiting *Helianthus lenticularis*, but they were all *M. aurigenia*, Cresson.

The female *M. robustior* runs in my tables in Trans. Amer. Ent. Soc., 1906, to *M. grindeliæ*, but is much larger, and is easily distinguished by the black hair of the thorax being separated from the tegulæ by a broad ochraceous band. In the arrangement of the hair on thorax it is like *M. semiagilis* (Ckll.), but that is a considerably smaller species, and the male is quite different. It is also close to *M. nigrosignata*, Ckll., but the facial quadrangle is broader and shorter, the hairless area on apical part of second abdominal segment is much less, and the abdomen beneath lacks the conspicuous black hair, contrasting with the pale at sides. The male *robustior*, in the same tables, runs to *M. gilensis*, but differs by the broad lemon-yellow clypeus, the yellow nearly reaching the eye; also by the yellow spot on labrum and less elevated vertex. It is easily known from *M. grindeliæ* by the light hair on tegulæ, very small amount of dark hair on mesothorax, &c. It is also close to *M. helianthophila*, Ckll., but differs by the ochraceous pubescence, dusky wings, darker antennæ, with the third joint twice as long, &c.

Bombus edwardsii, var. *kenoyeri*, var. n.

♀.—Like var. *bifarius* (Cresson), but the red colour of abdomen replaced by pale tawny, so that all the light abdominal hair is of the same colour. The second abdominal segment has a broad triangle of black hair at base.

Hab. Tolland, Colorado; at flowers of *Frasera stenosepala*, July (*L. A. Kenoyer*). Also on *Frasera stenosepala*, at Tolland, Mr. Kenoyer took *B. edwardsii bifarius* (Cr.), *B. rufocinctus astragali* (Ckll.), *Psithyrus insularis* (Sm.), *Colletes kincaidii*, Ckll., *Chelynia nitida* (Cr.), *Monumetha albifrons* (Kirby), and *Megachile wootoni calogaster* (Ckll.). *Bombus kirbyellus*, Curtis, was taken by Mr. Kenoyer on Nebraska Hill, Colo., above timber-line, July, at flowers of *Polemonium confertum* and *Trifolium*. At Corona, Colorado, above timber-line, he took *Bombus appositus*, Cr., at flowers of *Trifolium dasycarpum*, and *B. flavifrons* at *Mertensia bakeri*. *B. flavifrons* was also taken on Nebraska Hill at *Trifolium dasycarpum*.

Osmia kenoyeri, sp. n.

♂ (type).—Length nearly 11 mm.

Dark green, the head and thorax rather bluish green, the abdomen clear olive-green, the margins of segments concolorous; antennæ long, black, the middle joints of flagellum conspicuously swollen beneath; tegulæ piceous, green in front; legs black, without metallic tints; hair of head, thorax, first abdominal segment, and greater part of legs long and white, of second abdominal segment also white, but shorter, of segments 3 to 5 black, of sixth mixed black and white, a fringe of long white hairs at apex; head broad, quadrate, finely and very densely punctured; mandibles black; mesothorax and scutellum densely punctured; area of metathorax dull and granular. Wings hyaline. Tarsi with red hair on inner side; anterior tarsi with joints 2 to 4 having the anterior apex produced; middle tarsi with basitarsi obcordate, very short, and greatly swollen, very hairy, the hair mostly fuscous; hind basitarsi also broadened, but not so short, the inner margin with a prominent angle beyond the middle, the anterior face shining, not hidden by hair; spurs of hind legs dark, curved at end, not peculiar; small joints of middle and hind tarsi thickened, but not otherwise remarkable. Abdomen shining, sixth segment with a scarcely noticeable trace of an emargination, seventh strongly bidentate; second abdominal segment thickened on the apical middle; third deeply emarginate, the sides of the notch with a short fringe of orange hair.

♀.—Length about 10 mm.

Robust, tegumental colours like those of male, but clypeus and adjacent sides of face blue-black, supraclypeal area green, and face on each side of antennæ steel-blue; mandibles tridentate; clypeus subemarginate; hair of face long and entirely black, of cheeks up to sides of vertex black, but of head and thorax above pale orange-yellow, not mixed with black; middle of mesothorax with well-separated punctures; pleura and metathorax with black hair. Legs black, with black hair, except on anterior tarsi, where it is pale; first abdominal segment with yellowish-white hair, the others with black, the hair quite long and coarse; ventral scopa black.

Hab. Nebraska Hill, Colorado, at flowers of *Trifolium*, above timber-line, July 1915 (*L. A. Kenoyer*).

Known from all other North-American species by the structure of the male tarsi. The female may be compared with *O. hendersoni*, Ckll., but the abdomen is quite differently coloured and the sixth segment has not the pale reddish hair-fringe seen in *hendersoni*. The abdomen of *hendersoni* is smoother and less hairy. In Friese's tables of Palæarctic *Osmia* both sexes run near *O. angustula*, but are quite distinct from that species. Also on Nebraska Hill, above timber-line, but not on a flower, Mr. Kenoyer took a male *Osmia abnormis*, Cresson. On Nebraska Hill, at *Salix*, 100 feet below timber-line, Mr. Kenoyer took *Halictus sisymbrii*, Ckll.

Prosopis personatella, sp. n.

♀.—Length about 5·5 mm.

Head, thorax, and abdomen entirely black, without light markings; flagellum dull ferruginous beneath; head broad; front and vertex dull and very finely punctured, but region behind tips of eyes shining; mesothorax dullish, extremely minutely and closely punctured; scutellum broad and flat, shining, the punctures distinctly separated; metathorax dull, the area roughened; tegulæ black. Wings very ample, clear hyaline, nervures and stigma piceous; second s.m. large and long. Legs black, the hind tibiæ with rather more than the basal fourth cream-coloured. Abdomen shining, first segment with very minute, widely separated punctures, second microscopically lineolate. Under the compound microscope the base of metathorax appears cancellate.

Hab. Corona, Colorado, above timber-line, at flowers of *Erigeron pinnatisectus*, July (*L. A. Kenoyer*).

Readily known by the entirely black face, combined with the rather small size and ordinary antennæ. It has some superficial resemblance to the smaller *P. saniculæ*, Rob. At the same place and flowers Mr. Kenoyer took a male which I referred to *P. coloradensis*, Ckll., for, although it looks a little different from typical specimens of that species, there is nothing tangible on which to separate it. The female described above differs from *coloradensis* (*tuertonis*, Ckll.) not only by its black face, but also by the long second s.m. The mesothorax of *tuertonis* is much more deeply and strongly punctured. It therefore seems that we have to do with a distinct species, not a variety of *coloradensis*, and that the male *coloradensis* is not conspecific.

Prosopis varifrons, Cresson.

Females from Florissant and Boulder, Colorado, are recognizable by their relatively large size; lateral face-marks ending about the level of antennæ, where they are very obliquely truncate (approaching the form of those in the male); first abdominal segment very smooth and shining, second finely and distinctly punctured, in complete contrast. Metz (Trans. Am. Ent. Soc. xxxvii. pl. ix. fig. 130) figures as female *varifrons* an unusual variety or some other species. *P. subtristis*, Swenk. & Ckll., appears to be a race of *varifrons*, as was suggested in the original description. Metz, who makes *subtristis* a variety of *P. episcopalis*, Ckll., remarks that some of the species cannot be distinguished from *P. varifrons*. The male which Metz refers to *P. subtristis*, of which I have an example determined by Metz (Ormsby County, Nevada, July, *Baker*), is quite distinct, and is really related to *P. episcopalis*, having the yellow markings reduced and the lateral face-marks much narrower above. It is *P. universitatis*, Ckll., which Metz remarks "is probably the variety *subtristis*."

Prosopis luzonica, Cockerell.

♂.—Length about 7 mm.

Black, with broad transverse mark on lower margin of clypeus, lateral face-marks (rather narrow, notched at antennal sockets, and ending narrowly on orbital margin below level of middle of front), interrupted line on prothorax, spots on tubercles and tegulæ, anterior tibiæ in front, middle tibiæ at extreme base, rather more than basal third of hind tibiæ, and all the basitarsi yellow; flagellum long, the apical part ferruginous beneath.

Hab. Mt. Banahao, Philippine Is. (Baker coll. 3664).

The species was described from a female.

Prosopis mindanensis, sp. n.

♂.—Length about 6·5 mm.

Black, with a large triangular mark on lower part of clypeus, lateral face-marks (shaped like feet on tip-toe, broadly truncate at about level of middle of supraclypeal area, but continued narrowly a short distance up orbital margin), small stripe on scape, interrupted line on prothorax, tubercles, spot on tegulæ, anterior tibiæ in front, and bases of middle and hind tibiæ yellow; anterior tarsi ferruginous, the small joints dusky, the other tarsi black; face rather long and narrow; antennæ short for a male, reaching about to level of tubercles, third and fourth joints very short, flagellum obscure reddish beneath; mesothorax rather strongly and extremely densely punctured; area of metathorax coarsely wrinkled. Wings greyish hyaline; first r.n. meeting first t.-c.; second s.m. longer than high; first abdominal segment shining, with extremely fine punctures; the other segments also very finely punctured, without any distinct hair-bands or patches; stipites long and spine-like.

Hab. Dapitan, Mindanao (Baker coll. 3663).

Resembles *P. palavanica*, Ckll., but is distinguished by the shorter antennæ, yellow bases of middle and hind tibiæ, broader abdomen, &c. Among the continental Asiatic species it is related to *P. feai*, Vachal.

Apis indica nigrocincta (Smith).

Dapitan, Mindanao (Baker coll. 3660).

This agrees with a Chinese specimen from Smith's collection.

Xylocopa fuliginata, Pérez.

A new locality is Mt. Makiling, Luzon (Baker coll. 5233).

Mesotrichia bombiformis (Smith).

Baguio, Benguet (Baker coll. 4995). From the same locality comes a female *Xylocopa fuliginata* (Baker coll. 4994).

Nomioides valdezi, sp. n.

♂.—Length about 4 mm.

Head and thorax dark steel-blue, abdomen black; clypeus, labium, end of mandibles, broad but short stripe on scape, tubercles (with extension on sides of prothoracic margin), knees (the anterior broadly), tibiæ (except large dark mark on hind pair), and tarsi yellow; abdomen with rather narrow interrupted yellow bands at bases of second and third segments; front dull; mesothorax and scutellum brilliantly shining. Wings hyaline, nervures and stigma dilute sepia, second s.m. very small.

Variety *a*.—Abdomen with interrupted band only on third segment, and this may be nearly obsolete.

Hab. Cagayan, Mindanao (Baker coll. 3670).

Named after Julian Valdez, Professor Baker's collector. Very close to the Australian *N. perditellus*, Ckll., but differs by the much broader head, base of mandibles black, and much darker flagellum. The third antennal joint is not about twice as broad as long, as it is in male *perditellus*. The wings are not clear white, as they are in the European *N. variegatus* (Oliv.).

Nomioides melanogaster, sp. n.

♂.—Length 4·5–5·5 mm.

Head and thorax steel-blue; abdomen broad, black, without markings, the first segment variably bluish; clypeus (except two rather large black spots), labium, most of apical half of mandibles, margin of tubercles, knees, anterior tibiæ in front, and all the tarsi yellow; head broad; clypeus small, sparsely punctured; antennæ long, flagellum dark, very obscurely brownish beneath; sides of face greenish; front blackish, entirely dull; mesothorax and scutellum smooth and shining; area of metathorax large, dull, and granular, with the apical margin shining; tegulæ dark brown. Wings hyaline, stigma and nervures dilute brown. Abdomen shining.

Hab. Dapitan, Mindanao (Baker coll. 3162).

Allied to *N. valdezi*, but easily known by the larger size, dark tibiæ, &c.

Megachile albobarbata, sp. n.

♂.—Length about 9 mm.

Black, the head and thorax with black and white hair; abdomen densely covered dorsally with bright red (colour of red lead) tomentum, except the basal part of first segment (which is bare) and the caudal keel (which is broadly rounded, slightly emarginate in middle); head broad; clypeus shining, strongly punctured, the lower margin heavily and regularly fringed with white hair; under side of head with long white hair; sides of face with black hair, white hair between antennæ, black hair on vertex and sides and upper part of front; region behind ocelli broad, shining, with scattered large punctures; antennæ very long and slender, black; mesothorax shining, with well-separated distinct punctures; scutellum coarsely and more closely punctured; area of metathorax with a series of fine plicæ forming a transverse line near the base; dorsum of thorax with thin black hair, but anteriorly and posteriorly and on sides it is white; hind corners of mesothorax tufted with white hair; tegulæ black. Wings fuliginous. Anterior coxæ spined; anterior tarsi simple; hind tarsi long; hair of legs pale.

Hab. Dapitan, Mindanao (Baker coll. 3673).

Allied to *M. mystacea* (Fb.) from Australia, but smaller and with different sculpture. There is a general resemblance to *M. malayana*, Cameron.

Halictus taclobanensis, sp. n.

♀.—Length nearly 6 mm.

Robust, golden green; pubescence scanty, tinged with ochreous, that at apex of abdomen warm pale ochreous; mandibles broadly red in middle; basal half of the slender scape red, antennæ otherwise dark, the flagellum reddish at tip; basal part of legs green, but knees, tibiæ, and tarsi bright ferruginous, the hind basitarsi with a dusky stain; tegulæ pale testaceous. Wings clear hyaline, nervures and stigma dilute reddish, outer r. n. and t.-c. very weak, first r. n. meeting second t.-c; third s.m. narrow (short), smaller than second. Head broad, brassy green, densely rugoso-punctate, the clypeus with strong separate punctures; mesothorax golden-green, very densely punctured; scutellum blue-green, polished, the punctures small and weak; area of metathorax golden-green, very coarsely irregularly reticulate. Abdomen golden-green, smooth and polished, without distinct punctures, hind margins of segments not darkened; venter with a long curled scopa on second and third segments; hind spur much shorter than its mate, and furnished with three long blunt spines and a rounded lobe beyond.

Hab. Tacloban, Leyte, Philippine Is. (Baker coll. 3672).

Resembles *H. testaceipes*, Friese, from Java, but the abdominal segments are not dark-bordered, the femora are less red, &c.

Sphecodes bakeri, sp. n.

♀.—Length 7·5 mm.

Black, with the abdomen red, the apical part more or less dusky, but not black; small joints of tarsi obscure reddish; head much broader than long, eyes very prominent; mandibles falciform, bidentate, the apical part obscure red; clypeus densely punctured; antennæ black, third joint very short; mesothorax coarsely and extremely densely punctured; area of metathorax coarsely ridged, divided into two rows of large shining hollows, with a transverse ridge between them; hair of head, thorax, and legs white; tegulæ piceous, with a hyaline spot. Wings dilute fuliginous; second s.m. very high and narrow, receiving first r. n. a little before its end. Abdomen shining, impunctate; apex dark.

Hab. Dapitan, Mindanao (Baker coll. 3662).

Distinct from the species described from Java by the black legs and red abdomen; not very close to the species of India or Formosa. Genus new to Philippine Islands.

LVIII.—*Rhynchotal Notes.*—LVII. By W. L. Distant.

Homoptera.

Fam. **Membracidæ** (continued from p. 328).

Division Gargararia.

Gargara addahensis, sp. n.

Head, pronotum, and body beneath black; femora black, their apices and the tibiæ and tarsi testaceous; tegmina greyish white, their basal areas black, a narrow transverse fuscous fascia before apex and the extreme apical margin palely of the same colour; lateral areas of sternum greyishly tomentose; pronotum thickly punctate, sparingly shortly pilose, the lateral angles subprominent, the posterior process broad, robust, its apex subacute and reaching the posterior angle of the inner tegminal margin; basal tegminal dark area punctate.

Long. 3 mm.; breadth lat. pronot. angl. 2 mm.

Hab. W. Africa; Addah, Gold Coast (*H. T. Palmer*, Brit. Mus.).

A short, broad, and very robust species.

Gargara fraterna, sp. n.

Pronotum and legs pale chestnut-brown; face black, thickly, finely, palely pilose; tegmina pale chestnut-brown with pale greyish suffusions, principally appearing as a transverse fascia near base and small elongate spots on apical area, the apical margin also distinctly paler; body beneath greyishly pilose, a greyish-white spot at each basal angle of the posterior pronotal process; pronotum thickly finely punctate and obscurely pilose, the lateral angles subprominent, with a strong percurrent central longitudinal ridge, posterior pronotal process broad and robust, distinctly centrally concavely sinuate, its apex black, subacute, and recurved downwardly, slightly passing the posterior angle of the inner tegminal margin.

Long. 3 mm.; breadth lat. pronot. angl. 2 mm.

Hab. W. Africa; Addah, Gold Coast (*H. T. Palmer*, Brit. Mus.).

Allied to the preceding species, but, apart from its different colour and markings, the posterior pronotal process is a little longer and more concavely sinuate.

Gargara perpolita, sp. n.

Head, pronotum, and legs black; tegmina greyish white, about basal fourth black and apical third purplish black; abdomen beneath greyish white, with the segmental margins black; pronotum thickly, somewhat coarsely punctate, centrally, percurrently, longitudinally ridged, the lateral angles subprominent, the posterior pronotal process broad, robust, almost straight above, the apex subacute, a little recurved and distinctly passing the posterior angle of the inner tegminal margin.

Long. 3–4 mm.; breadth lat. pronot. angl. 2½–3 mm.

Hab. Uganda Prot.; Budongo Forest, Unyoro, 3400 ft. (*S. A. Neave*).

Var.—The apical third dark area of the tegmina appearing only as two united transverse fasciæ.

Hab. Uganda Prot.; Mpanga Forest, Toro, 400–800 ft. (*S. A. Neave*).

Gargara œnea, sp. n.

Head, pronotum, and legs black; body beneath black, obscurely, shortly pilose; tegmina bronzy brown, the basal area, narrow costal margin, apical margin and apical area of inner tegminal margin, black or piceous, in some specimens a subapical spot of the same colour; pronotum thickly punctate, the central, longitudinal, percurrent carination more pronounced on the posterior process, which is very slightly sinuate, its apex obtusely acute and reaching the posterior angle of the inner tegminal margin, lateral angles subprominent; dark basal area of tegmina punctate.

Long. 6 mm.; breadth lat. pronot. angl. 3½ mm.

Hab. Uganda Prot.; Entebbe and Budongo Forest, Unyoro, 3400 ft. (*S. A. Neave*).

Gargara aterrima, sp. n.

Head, pronotum, body beneath, and legs shining black; tegmina black, the apical area more or less pale bronzy brown; pronotum thickly, coarsely punctate, somewhat faintly, longitudinally, percurrently carinate, the posterior pronotal process broad and robust, strongly tricarinate, the apex obtusely acute and reaching the posterior angle of the inner tegminal margin; this process is nearly straight, scarcely at all sinuate, strongly ridged above, and declivous on each side.

Var.—Tegmina totally black with the exception of a narrow transverse ochraceous fascia near base.

Long. 6 mm.; breadth lat. pronot. angl. 2½ mm.

Hab. Uganda Prot.; Budongo Forest, Unyoro, 3000–4000 ft. (*S. A. Neave*); Buamba Forest, Semliki Valley, 2300–2800 ft. (*S. A. Neave*); Mabira Forest, Chagwe (*C. C. Gowdey*).

The typical specimens were received from Mr. Neave, the varietal form (one) from Mr. Gowdey.

Gargara asperula.

Centrotus asperulus, Walk. List Hom., Suppl. p. 162 (1858).

Hab. Sierra Leone.

Gargara semifascia.

Centrotus semifascia, Walk. Journ. Linn. Soc., Zool. i. p. 94 (1857).

Hab. Malacca, Borneo.

Gargara semivitrea.

Centrotus semivitreus, Walk. Journ. Linn. Soc., Zool. i. p. 94 (1857).

Hab. Singapore.

Gargara minuscula.

Centrotus minusculus, Walk. Journ. Linn. Soc., Zool. x. p. 191 (1868).

Hab. Mysol.

Gargara biplaga.

Centrotus biplaga, Walk. Journ. Linn. Soc., Zool. x. p. 191 (1868).

Hab. Celebes.

Gargara venosa.

Centrotus venosus, Walk. Journ. Linn. Soc., Zool. x. p. 189 (1868).

Hab. Tondano.

Gargara consocia.

Centrotus consocius, Walk. Journ. Linn. Soc., Zool. i. p. 164 (1857).

Hab. Borneo.

Uroxiphus simplex.

Centrotus simplex, Walk. Insect. Saund., Homopt. p. 78 (1858).

S. Africa.

Terentius rolandi, sp. n.

Head, pronotum, and body beneath black, legs piceous (face mutilated in unique type); tegmina shining ochraceous, the apical area shining, brilliant castaneous, base, costal area, and very narrow apical margin black; pronotum thickly, coarsely punctate, centrally, percurrently, longitudinally carinate, the carination somewhat faint on anterior area and more pronounced on the posterior process, which is apically attenuated, its extreme apex acute, and passing the posterior angle of the inner tegminal margin; tibiæ distinctly pilose; lateral areas of the sternum greyishly tomentose.

Long. 8 mm.; breadth lat. pronot. angl. 4 mm.

Hab. N. Queensland; Kuranda, 1–100 ft. (*R. E. Turner*).

Terentius punctatissimus.

Terentius punctatissimus, Stål, Œfv. Vet.-Ak. Forh. 1869, p. 286.
Centrotus spissus, Walk. MS.
Centrotus pictipennis, Walk. MS.

Hab. New Guinea (*Wallace*); Batchian (*Doherty*); Dorey (*Wallace*).

Two specimens in the British Museum are labelled *C. spissus* and *C. pictipennis*, Walk., but I cannot trace any description of the species.

Terentius retractus.

Centrotus retractus, Walk. Journ. Linn. Soc., Zool. x. p. 190 (1868).

Morty (*Wallace*).

Terentius conterminus.

Centrotus conterminus, Walk. Journ. Linn. Soc., Zool. x. p. 190 (1868).
Centrotus curtulus, Walk. *loc. cit.* p. 190 (1868).

Aru (*Wallace*).

Terentius reductus.

Centrotus reductus, Walk. Journ. Linn. Soc., Zool. x. p. 190 (1868).

New Guinea (*Wallace*).

Terentius nubifasciatus.

Centrotus nubifascia, Walk. Journ. Linn. Soc., Zool. x. p. 191 (1868).

New Guinea.

Terentius densus.

Centrotus densus, Walk. Journ. Linn. Soc., Zool. x. p. 189 (1868).

New Guinea.

Under the too all-embracing genus *Centrotus*, as used by Walker, that writer described two species under the name of *C. densus*—one the above, and another from Borneo (Journ. Linn. Soc., Zool. i. p. 163, 1867). As these two species belong to different genera, both names are available.

TIBERIANUS, gen. nov.

Pronotum anteriorly gibbous and rounded, its frontal area somewhat truncate and a little inclined inwardly, strongly, centrally, longitudinally, percurrently carinate, the anterior area with a strong carination on each side of the central one and parallel with it, the posterior process only slightly elevated above the scutellum, moderately slender and impinging on the tegmina, the apex subacute, and reaching or passing the posterior angle of the inner tegminal margin; legs moderately robust but not dilated; tegmina with four apical and two discoidal cellular areas.

This genus is to be recognized by the tricarinate surface of the anterior disk of the pronotum combined with its unarmed lateral angles.

Tiberianus typicus, sp. n.

Pronotum testaceous, its disk and the posterior process more or less piceous; face testaceous, thickly, finely, palely pilose; legs and abdomen beneath testaceous, the sternum more piceous; tegmina subhyaline, wrinkled, the base narrowly testaceous or piceous, the costal margin testaceous, the venation pale fuscous; pronotum finely pilose and punctate, the pronotal ridges very prominent; other structural characters as in generic diagnosis.

Long. 4 mm.; breadth lat. pronot. angl. 2½ mm.

Hab. S.E. Rhodesia; Umtali, 3700 ft. (*G. A. K. Marshall*).

Tiberianus bulbaceus, sp. n.

Head, pronotum, and legs fuscous-brown; tarsi ochraceous; tegmina subhyaline, wrinkled, the base fuscous-brown margined outwardly with an obscure pale ochraceous macular fascia, costal area more or less shaded with fuscous-brown, the venation concolorous, very obscurely and finely speckled with fuscous-brown; pronotum thickly punctate, very obscurely pilose, centrally, longitudinally, moderately, percurrently carinate, the discal area tricarinate, the lateral carinations parallel to the central one, the lateral angles subprominent, the posterior process tricarinate, its apex subacute and distinctly passing the posterior angle of the inner tegminal margin.

Long. 5 mm.; breadth lat. pronot. angl. 2½ mm.

Hab. Cape Colony; Stellenbosch (*G. A. K. Marshall*).

Demanga deflectens, sp. n.

Head, pronotum, and scutellum shining black; face more or less and base of scutellum thickly ochraceously pilose; legs black; lateral areas of sternum ochraceously pilose;

tegmina bronzy brown, extreme basal area black, narrow costal area piceous, black at base, immediately beyond the black basal area a macular transverse pale ochraceous fascia; ocelli about as far from eyes as from each other; face very strongly deflected; pronotum unarmed, coarsely punctate, the disk elevated, posterior process somewhat slender, strongly tricarinate, at a distance from scutellum, straightly obliquely deflected from near base, and impinging on inner margin of tegmina near its posterior angle; scutellum with the apex upwardly recurved.

Long. 6½ mm.; breadth lat. pronot. angl. 3 mm.

Hab. Brit. E. Africa; Ngare Narok, 12,000–13,000 ft. (*Capt. A. O. Luckman*); W. slopes of Kenya, on Meru-Nyeri Rd., 6000–8500 ft. (*S. A. Neave*). German E. Africa; Ruanda Distr. (*Dr. C. K. Marshall*).

The genus *Demanga* was founded for the reception of an Indian species; it is now also found to be represented in the Ethiopian Region.

PROMITOR, gen. nov.

Pronotum elevated, practically unarmed, strongly centrally longitudinally carinate, on each side near base an irregular foveate spot, the margin of which is strongly irregularly ridged, the posterior process robustly recurved to apex of scutellum, after which the apical area is slender, linear, and upwardly and backwardly recurved, the lateral pronotal angles shortly and obsoletely subacute.

Allied to the Oriental genus *Coccosterphus*, Stål, but differing in the entirely divergent structure of the posterior pronotal process, the completely visible scutellum, &c.

Promitor nominatus, sp. n.

Head fuscous-brown; pronotum pale ochraceous; legs pale brown, the apices of the femora and the whole of the tarsi ochraceous; body beneath fuscous-brown; tegmina subhyaline, wrinkled, the base, a subcentral fascia, a more oblique subapical fascia, and some irregular apical spots fuscous-brown; pronotum thickly coarsely punctate, the posterior process robustly recurved to apex of scutellum, after which the apical area is slender, linear, and upwardly and backwardly recurved, about or almost reaching the posterior angle of the inner tegminal margin; face moderately deflected.

Long. 5 mm.; breadth lat. pronot. angl. 2½ mm.

Hab. Natal (Brit. Mus.); mouth of Umkomaas River (*G. A. K. Marshall*).

UMFILIANUS, gen. nov.

Pronotum elevated, the front oblique, the posterior process moderately slender, tricarinate, convex at base, well separated from scutellum (which is quite exposed and about as long as broad), its apical area impinging on the tegminal suture and the apex about reaching the inner tegminal margin, lateral angles subprominent; ocelli almost as far apart from each other as from eyes; face a little concavely declivous; legs simple; tegmina with four apical areas.

By the shape and direction of the posterior pronotal process resembling the genus *Indicopleustes*, Dist., but altogether removed from the division in which that genus is located by the absence of lateral pronotal processes.

Umfilianus declivis, sp. n.

Head and pronotum black; legs black or piceous; body beneath black or piceous, the abdominal segmental margins ochraceous; tegmina subhyaline, wrinkled, base and subcostal area obscurely ochraceous, the costal, subcostal, and apical veins black, the interiors of the basal cells also blackish; scutellum about as long as broad, its apex and a small spot at each basal angle greyishly tomentose; lateral areas of the sternum ochraceously tomentose; pronotum thickly finely punctate; other structural characters as in generic diagnosis.

Long. 6 mm.; breadth lat. pronot. angl. 3 mm.

Hab. Mashonaland; Umfili River (*G. A. K. Marshall*).

LIX.—*On the Extension of the Range of the American Slipper-Limpet on the East Coast of England.* By G. C. ROBSON, B.A.

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RECORD of the progress of the American slipper-limpet (*Crepidula fornicata*) in its invasion of the English coastal waters was brought up to date by Orton (1) when he described its occurrence at Emsworth, in Hampshire. This gave the animal a range from Mersea Island (Essex) to Hampshire, with a secondary area of distribution (apparently quite disconnected with the S.E. one) on the Lincolnshire and Yorkshire coast (discussed by Murie (2)). In the summer of the present year the westward range was extended by the discovery by Col. Worthington Wilmor of shells of the species at Ryde (Isle of Wight).

Hitherto no records have been forthcoming of the extension of the animal's range up the East Coast from the Colne estuary. However, in September of the present year I received a number of shells of the species from Miss B. Nicholson, who had found them on the beach at Frinton-on-Sea (Essex). Miss Nicholson informs me that she found the same form at Frinton in 1914, only in far less quantity than in the present year.

Having some knowledge of the features of the N. Essex coastal waters, I thought it would be interesting to follow Miss Nicholson's discovery up. I accordingly communicated with persons at Walton-on-Naze, Dovercourt, and Woodbridge Haven, and, as a result, found that *Crepidula fornicata* has established itself all along the Essex and Suffolk coast from Frinton to the mouth of the River Deben (Woodbridge Haven). I hope that field-naturalists will follow up this clue and attempt to determine its present range and record its further progress.

A few remarks upon the method by which this species is extending its range may be offered at this point. In the first place, it is highly probable that the extension up the Essex coast from Mersea Island and the mouth of the Colne River, at least along the Clacton-Frinton coast-line, was effected by the free-swimming larva. Orton has pointed out (3) that the spat of *Crepidula* can be caught upon floating rafts: so it is not impossible that the larvæ might settle down upon the submerged and projecting parts or tackle of a coasting vessel plying between the places involved, just as they settled down on the raft in the experiment described by Orton. But, owing to the excessive shallowness of the water off Frinton, no coasting vessels call there. It is just possible that yachts that lie up at Brightlingsea during part of the year, and during the rest are used off the coast, may have carried spat about with them, but the number of such yachts that visit Frinton is very small. With regard to the extension of range to Dovercourt and the Suffolk coast, it is possible that a small coaster or sea-going wherry may have acted as the disseminating agent, carrying the spat from the Colne estuary to Harwich and Woodbridge Haven (the latter being accessible to coasting traffic). Dovercourt, on the other hand, is not visited by coasting traffic for the same reason as Frinton is not. On the other hand, the animal may be effecting its extension of range entirely in the larval (free-swimming) stage. In this case it would be, on the whole, favoured by the tidal stream (*cf.* Orton (7)). According to information kindly supplied by the Hydrographical Department of the Admiralty, the tidal stream runs from Orfordness to Harwich nearly parallel to the coast S.W. on the flood, turns W.S.W. across the shoals into Harwich Harbour, S. off the Naze, S.W. off Frinton, and W. by N. off the Wallet into the Blackwater River. On the ebb the above bearings are all approximately reversed. Further, the ebb or N.E. going tide is slightly stronger than the flood—a fact which would tend to favour the spread of the larvæ up the coast northwards. Dr. Fowler informs me that the general normal drift (resultant of tide + wind + current) is south-westerly. As Lo Bianco has pointed out (4), the annual distribution of plankton is very much affected by drift-currents (those produced by wind), so we cannot afford to neglect this factor (see below).

North of the Naze the Essex coast is indented by an irregularly-shaped arm of the sea, several miles in area, and consisting of sands uncovered at low tide, saltings and channels of various width meandering among sand and mud-flats. It would be extremely interesting to discover if *Crepidula fornicata* has spread round this maze of channels and flats and reached the Dovercourt coast by this route, or whether, as is more probable, it is absent from this area, having been carried across to the opposite coast direct by the tidal stream.

In any case, whether *Crepidula fornicata* is extending its range by natural transit or as a "stowaway" on coasting vessels and yachts, the alternatives are sufficiently interesting to warrant discussion. It should be pointed out that, if the first method is the one responsible, the progress must be slow, as the balance in favour of the N.E. going ebb is not very great, the extreme rates of the ebb and flow being as follows*:—

		Knots.
* Ebb (N E)	3 hours after H.W. Dover......	0·8 to 1·9
	4 " " "	0·7 to 1·5
Flood (S W)	4 hours before H.W. Dover ..	0·1 to 1·7
	3 " " " ..	0·5 to 1·7

According to Orton (5) the spawning-period of *C. fornicata* extends from March to November, the veligers swimming free for about two weeks (Conklin (6)). Larvæ are thus practically certain to be present in the plankton during April, in which month, according to information kindly given me by Commander Campbell Hepworth, the wind on this coast varies from S.W. to N.W. We have thus a period during which the drift-currents will accelerate the N.E. going ebb and favour the northward dispersal of the larvæ.

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* At the Cork Light off Harwich.

WORKS QUOTED.

(1) ORTON, J. H. Proc. Malacological Soc xi. 4, 1915, p. 190.
(2) MURIE, J. 'The Zoologist,' no. 845, November 1911.
(3) ORTON, J. H. Journ Marine Biol Assoc x. 2, 1914, p 320.
(4) LO BIANCO, S. Mitth. Zool. Station zu Neapel, 19 Bd 4 Hft. 1909, p 527.
(5) ORTON, J. H. Journ Marine Biol Assoc. ix. 3, 1912, p. 439.
(6) CONKLIN, E. G. Journ. Morphology, xiii. 1897, p 19.
(7) ORTON, J. H. Trans. Plymouth Inst. xv. 4, 1915, p. 250.

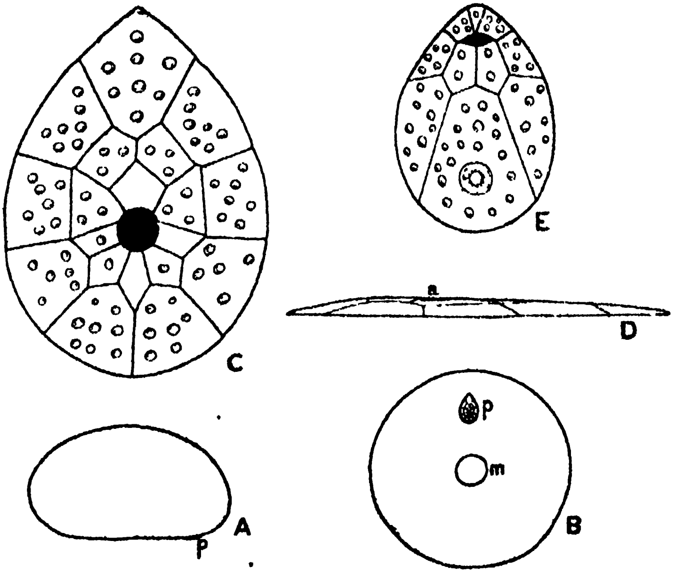
LX.—*On the Periproctal Plates of* Discoidea cylindrica (*Lamarck*). By FREDERICK J. NORTH, B.Sc., F.G.S., Assistant Keeper, Geological Department, National Museum of Wales.

THE periproct in fossil echinoids belonging to the Exocycloida usually appears as an open hole in the posterior interambulacrum, the plates which covered it during life being lost as a result of the decomposition of the membrane which held them together. This is not to be wondered at when the large size (in many genera) and the exposed position of the periproct are considered. Occasionally, however, the periproct is seen to be covered by a mosaic of plates surrounding the very small anal aperture; but this is so rare an occurrence that little or nothing is known concerning the periproctal system of many genera. It therefore seems desirable that any such occurrence should be recorded, especially as the few instances that are known suggest that the system is of taxonomic value.

The following is an account of the plates as seen in a specimen of *Discoidea cylindrica* (Lamarck) from the Upper Chalk of Swaffham, Norfolk, and now in the Geological Department of the National Museum of Wales (reg. no. 15. 156. G. 8).

The specimen in question has a small, almost hemispherical test, the shape and proportions of which are indicated by the plan and profile (text-fig., B & A). The periproct, which occupies a position on the adoral surface rather nearer to the ambitus than to the mouth-opening, is oval in shape, rounded adorally, and acuminated adapically. It is 4 mm. long and 2·75 mm. wide.

The anal aperture, which is rather less than 0·5 mm. in diameter, is situated on the adoral half of the long axis of the periproct, and since the whole system is adapically situated, the anus is just midway between the ambitus and the oral opening. It is raised slightly above the plane of the



A, B, C, D. *Discoidea cylindrica* (Lamarck), Upper Chalk, Swaffham, Norfolk. In Geol. Dept., National Museum of Wales, Reg. no. 15. 150. G. 8.

A. Profile (*p*, periproctal system), nat. size.
B. Plan of adoral surface (*m*, mouth-opening), nat. size.
C. Periproctal plates, × 12.
D. Ditto, side view (*a*, anal aperture), × 12.

E. Periproctal plates of *Discoidea minima*, Agassiz, enlarged (after Wright).

adoral surface of the test, and is surrounded by the periproctal plates, which slope from it in all directions, giving the whole system the appearance of a low boss (text-fig., A *p* & D).

The periproctal plates are nineteen in number, arranged in two cycles of nine plates each, with one odd pentagonal plate adjacent to the anus. The plates of the outer ring are larger than those of the inner ring, the largest being the unpaired lozenge-shaped plate at the adapical end of the system. The unpaired plate of the inner cycle, which resembles in shape, but is smaller than, the unpaired plate of the outer cycle, is situated adorally. None of the plates bear primary tubercles, but miliary granules occur on most of them; probably all were originally so granulated, the granules, which are necessarily very small, having been obliterated during the cleaning of the specimen.

The periproctal system of the specimen under consideration differs in certain important respects from that of *Discoidea minima*, Agassiz, which was described and figured by Cotteau *, and copied by Wright †; it also does not conform to the generalized account for the genus *Discoidea* given by Mr. Hawkins ‡; this is, however, accounted for by the fact that, at the time of writing, that author had not had the opportunity of examining the periproctals of *D. cylindrica*. From *D. minima* the specimen described differs in having a larger number of periproctal plates, none of which bear tubercles, and in the absence of any conspicuously large plate corresponding with the adoral plate of *D. minima*. In the latter the outer cycle has eight and the inner cycle only two plates, nearly half the total area of the periproct being occupied by one plate. Further, the anus is situated adapically, instead of adorally as in *D. cylindrica*.

No specimen of *D. cylindrica* of the elevated hemispherico-cylindrical type, in which the periproctals are preserved, has come under the notice of the writer, but, taking the specimen here described as representative of the large *Discoideæ*, and *D. minima* as representative of the series of small species, including *D. subuculus* (Klein), the nature of the periproctal mosaic seems to be a further item of evidence favouring the separation of the two series.

Other genera in which the periproctal plates bear some resemblance to those of *Discoidea* are *Cœnholectypus* and *Echinoneus*, both of which, however, have more plates and do not possess the bilateral symmetry characteristic of *Discoidea*.

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* Cotteau, Pal. Française, tom. vii. (1866) pl. 1012.

† T. Wright, "Cretaceous Echinodermata," Mon. Pal. Soc. vol. i. (1873) p. 219, pl. xlvii. fig. 4 *h*.

‡ H. L. Hawkins, Proc. Zool. Soc. 1912, p. 467.

LXI.—*Three new Species of the Dipterous Genus* Olbiogaster, *O.-S., in the British Museum Collection.* By F. W. EDWARDS, B.A., F.E.S.

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THE genus *Olbiogaster* was founded by Osten-Sacken in 1886 (Biologia Centrali-Americana, Diptera, vol. i. p. 20) for an insect belonging to the family Rhyphidæ, of which he had seen specimens from Costa Rica and Porto Rico; at the same time he referred to the new genus Bellardi's *Rhyphus tæniatus*, described from Mexico. Townsend (Ann. & Mag. Nat. Hist. ser. 6, xx. p. 21, 1897) recorded another specimen of *O. tæniatus* from Mexico; Williston in 1901 (Biologia Centr.-Amer., Dipt. vol. i. Suppl. p. 229, and pl. iv. fig. 6) described and figured another Mexican specimen; and, finally, Enderlein in 1910 (Stett. ent. Zeit. vol. lxxi. p. 65) described another species from South Brazil.

It will thus be seen that the very few known specimens of this interesting genus were all obtained in the Neotropical region. The British Museum contains examples of two additional species from West Africa and Ceylon, and, as these specimens so greatly extend our knowledge of the geographical range of the genus, it seems worth while to describe them. At the same time it may be desirable to give a name to the specimen figured by Williston and to call attention to some inaccuracies in his depiction of the wing-venation.

1. *Olbiogaster sackeni*, sp. n. (Williston MS.)

This name is proposed for the above-mentioned specimen figured by Williston, who refrained from naming it himself as he was unable to compare it with the description of *O. tæniatus*, Bellardi. According to this latter description there is a very marked difference in the coloration of the legs in the two specimens, and, while it is indeed possible that they represent merely varieties of one species, it will, in view of this difference, be convenient to refer to Williston's specimen under a separate name. The distinction is as follows:—

O. tæniatus, Bell. Legs black, the apex (*parte antica*) of the front femora, the front tibiæ, the base of the middle and hind tibiæ, and the apex of the hind femora yellow.

O. sackeni, sp. n. Legs yellow, the base of the four anterior femora, the whole of the hind femora, the extreme tip of the hind tibiæ and the distal joints of all the tarsi blackish.

In Williston's figure the vein R_{2+3} (second longitudinal) is represented as terminating in R_1 (first longitudinal) just before the tip of the latter, while Osten-Sacken describes both these veins as terminating in the same point in the costa, and presumably on this account he named his species *O. cognatus*. An examination of the types of the two species in the British Museum, however, shows that both these statements are incorrect; in reality, R_{2+3} terminates in the costa distinctly beyond the tip of R_1, as figured by Philippi in the nearly allied (and possibly identical) genus *Lobogaster*. Williston also incorrectly represents the upper two of the three veins arising from the discal cell as springing from the same point, while he omits the M-Cu cross-vein, which is really quite distinct, and shows Cu_2 as being slightly arched upwards instead of downwards. All these points combine to give quite a wrong idea of the venation, which is really very little different from that of *Lobogaster*. Neither Osten-Sacken nor Williston mentions the fact that the costal vein, instead of terminating as in *Rhyphus* at the tip of R_{4+5} (third longitudinal), extends about halfway from that point to the tip of M_1.

2. *Olbiogaster africanus*, sp. n.

♂. *Head*: Vertex and occiput shining black, with some not very conspicuous black hair; front shining black above, dull grey towards the antennæ; clypeus shining dark brown, lighter towards the eye-margins, with some dark hair. Ocelli close together in a nearly equilateral triangle. Antennæ in both sexes nearly twice as long as the head and thorax combined, black, the two basal joints reddish yellow; joints of flagellum about twice as long as broad. Palpi yellowish, the tip of the last joint dark. *Thorax*: Prothoracic lobes yellow; mesothoracic scutum shining black, except for a narrow yellowish side margin extending from the humeral callus to the base of the wing, sparsely clothed with rather long whitish-yellow hair; scutellum and postnotum blackish. Pleuræ shining dark brown, with a large shimmering grey patch. *Abdomen* black, somewhat shining, with narrow yellow apical margins to segments 1–5, which are narrowest in the middle; pubescence black, except on these yellow bands, where it is white. Segments 6 and 7 are somewhat expanded and, like the genitalia, are entirely black. *Legs*: Coxæ black, the front pair more or less yellow; femora yellow; tibiæ dark brown, with some slender short black bristles on the under sides, spurs yellow; tarsi blackish. *Wings* practically hyaline, the stigma dark brown; venation as in *O. sackeni*. *Halteres* with yellowish stem and dark knob.

♀. Resembles the male, except that the mesothoracic scutum is brown in the middle; the yellow apical margins to the abdominal segments are obsolete, although the white pubescence is conspicuous; the abdomen is narrowed towards the tip instead of having segments 6 and 7 expanded.

Length (without antennæ) 7–8 mm.

ASHANTI: 2 ♂ (including type), 2 ♀ from Obuasi, 7. vi., 24. vi., 5. vii., and 1. x. 1907, caught on leaf and on window (*Dr. W. M. Graham*). S. NIGERIA: 1 ♂, Oshogbo, 23. viii. 1910, in house (*Dr. T. F. G. Mayer*).

3. *Olbiogaster orientalis*, sp. n.

♀. *Head* mainly yellow; a large shining blackish-brown triangular spot on the vertex, with its apex extending down the front almost to the base of the antennæ, and at the level of the ocelli connected with the eyes by a small projection on each side. Clypeus mainly occupied by a round black spot, the margin remaining yellow. Antennæ with the two basal joints yellow, the next three black (remainder missing); first flagellar joint a little over twice, second and third three times as long as broad, with a very short black pubescence. Palpi and labella yellow. *Thorax*: Prothoracic lobes shining black, except on upper edge, which is yellow. Scutum mainly shining black; margin and a pair of humeral spots yellow; no long pubescence (possibly denuded); lighter brown areas in the middle and on the anterior part of the post-alar calli. Scutellum yellow. Postnotum black, with some long pale hairs. Pleuræ shining black, upper margin yellow, a whitish spot above the middle coxæ. *Abdomen*: segments 1–5 blackish, with large yellow, basal, lateral spots which, except on the first segment, are triangular; sixth segment black, except that the posterior margin is narrowly white; seventh segment and ovipositor yellow. Pubescence long and pale on the first segment, short on the remainder and of the same colour as the underlying integument. *Legs*: Front and middle coxæ yellow; hind coxæ (which are distinctly the shortest) blackish. All the femora and the front tibiæ yellow; the hind femora darkened at the tip; middle and hind tibiæ dark brown, lighter towards the base; tarsi blackish brown. *Wings* nearly hyaline; the apical third and the posterior margin slightly but distinctly infuscated; stigma blackish; a brownish mark across the R–M cross-vein, and another at the tip of the discal coll. Venation as in *O. sackeni*, except that Cu_2 is almost straight.

Length (without antennæ) 10 mm.

CEYLON: Pundaluoya, July 1897 (*E. E. Green*); a single female.

LXII.—*The Name of the Species described by Gray as* Galidictis vittatus. By R. I. POCOCK, F.R.S.

IN my recent revision * of the species formerly referred to the genus *Galidictis*, I pointed out that the form described by Gray as *G. vittata* (P. Z. S. 1848, p. 22) may be placed in a distinct genus, for which the name *Mungotictis* was proposed. At the same time I adopted for that animal the name *vittata*, or, rather, *vittatus*, given to it by Gray. Señor A. Cabrera, of the Museo de Ciencias Naturales, Madrid, has, however, kindly written to inform me that that name is inadmissible, because in 1844 Schinz (Syst. Verz. Säug. i. p. 360) employed it for the species described and figured by I. Geoffroy as *Galidictis striata* (Mag. de Zool. 2nd ser. i. 1839, pp. 32–33, pl. xviii.). Although, according to modern views, Schinz had no right to make this alteration, his action, nevertheless, invalidated the use of *vittata* for a second species assigned to *Galidictis*; and this conclusion is, of course, not in any way affected by the subsequent removal of *vittatus*, Gray, to the genus *Mungotictis*.

I propose, therefore, to rename the species in question *Mungotictis lineatus*.

Señor Cabrera further points out to me, and quite rightly, that if, as I suggested, my *Galidictis ornatus* should prove by chance to be identical with the one to which I. Geoffroy gave the inadmissible name *striata*, then Schinz's name *vittata* must be adopted for that species. But the present state of our knowledge of *G. vittata*, Schinz (=*striata*, Geoffr.), makes such an identification impossible; and unless Geoffroy's specimen is still preserved in the Paris Museum, and shows the published differences between *G. vittatus* and

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* Ann. & Mag. Nat. Hist. (8) xvi. pp. 113-124 (Aug. 1915).

G. ornatus to be due to errors on the part of the describer and artist, the two forms must be regarded as distinct on the available evidence as to the constancy of the distinguishing characters relied upon.

Since the synonymies of the three species above discussed are somewhat complicated, it may simplify matters to restate them briefly:—

1. *Mungotictis lineatus*, nom. nov.

Galidictis vittatus, Gray, P. Z. S. 1848, p. 22.
Mungotictis vittatus, Pocock, Ann. & Mag. Nat. Hist. (8) xvi. p. 121, pl. vii. fig. 3 (1915).
Nec *Galidictis vittatus*, Schinz, Syst. Verz. Saug. i. p. 360 (1844).

2. *Galidictis vittatus*, Schinz, Syst. Verz. Säug. i. p. 360 (1844).

Galidictis striata, Is. Geoffroy, Mag. de Zool. 2nd ser. i. pp. 32–33, pl. xviii. (1839).
Nec *Viverra striata*, Desm. 1820 (= *Galidictis fasciatus*, Gmel., 1788).

Described by Geoffroy as having five wide black bands and two smaller ones on the body, thus suggesting the presence of a broad median spinal stripe. The figure shows a median dorsal stripe and four on the side, one of them short.

3. *Galidictis ornatus*, Pocock, Ann. & Mag. Nat. Hist. (8) xvi. p. 118, pl. vii. fig. 2 (1915).

With four black stripes on each side and no median dorsal stripe.

LXIII.—*On the African Shrews belonging to the Genus* Crocidura.—VI. By Guy Dollman.

[Continued from p. 380.]

Group 17 (*hildegardeæ*).

Size small. Colour above reddish or dark brown. Skulls rather flat. Second and third upper unicuspids about equal in size.

(94) *Crocidura maanjæ*, Hell.

Crocidura maanjæ, Heller, Smith. Misc. Coll. vol. lvi. no. 15, p. 4 (1910).

Allied to *hildegardeæ*, but distinguished by its darker colour, narrower skull, and rather heavier teeth.

General proportions much as in *hildegardeæ*.

Colour of dorsal surface seal-brown, merging gradually on the sides into the greyer underparts. In the Museum Collection there is a specimen from Toro which may be accepted as representing this species; the new unbleached fur is dark seal-brown as described by Heller—patches of the old worn coat, still retained by this individual, are much redder in tint, about as in "Prout's brown." Backs of hands and feet dark brownish. Tail dark sepia-brown, a trifle paler below; caudal bristle-hairs numerous.

Skull rather narrower than that of *hildegardeæ*, the Toro specimen with rather a higher brain-case than in the Fort Hall species, in shape more as in *jacksoni*. Teeth rather heavier, second upper unicuspid a trifle smaller than third.

Dimensions of the type (as given by Heller):—

Head and body 82 mm.; tail 52; hind foot 12·5 (measured dry).

Skull: greatest breadth 8·7; length of tooth-row 8·5.

Skull-dimensions of Toro specimen: condylo-incisive length 18·7; greatest breadth 8; least interorbital breadth 4; length of palate 7·6; postpalatal length 8·5; greatest maxillary breadth 6; length of upper tooth-row 8·1.

Hab. Kabula Muliro.

Type. Adult male. U.S. Nat. Mus. no. 164639.

(95) *Crocidura hildegardeæ*, Thos.

Crocidura hildegardeæ, Thomas, Ann. & Mag. Nat. Hist. (7) vol. xiv. p. 240 (1904).

Size rather smaller than in *jacksoni*, about as in *gracilipes*, skull with flat brain-case and the second and third upper unicuspids about equal in size.

Hind foot small, about 12·5 mm. in length.

Colour above dull cinnamon-brown very finely speckled with buff, general effect as in "mummy-brown" mixed with "Prout's brown," very different from the dull brown and silver-grey mottling of *jacksoni*, and considerably brighter than in *gracilipes*. Flanks rather greyer than back, the brown tint, in the new pelage, merging rather abruptly into the lighter grey of the belly; in the more worn pelage, where the ventral surface is rather browner, the differentiation between the two areas is less distinct. Belly greyish. Lateral glands small, as in *gracilipes*. Backs of hands and feet dirty white or brownish. Tail slender and cylindrical, very finely haired, considerably more naked in appearance than in *jacksoni*, more as in *gracilipes*, upper surface brown, rather paler below; bristle-hairs grey or light brown, very inconspicuous.

Skull rather smaller than in *jacksoni*, with smaller and much flatter brain-case; muzzle and maxillary region considerably narrower. Teeth smaller, second and third upper unicuspids about equal in size, heart-shaped in section, the third slightly overlapping the internal posterior angle of the second. Compared with *gracilipes* the skull is smaller and flatter, with smaller teeth.

Dimensions of the type (measured from dry skin):—

Head and body 78 mm. (stretched); tail 50; hind foot 12·5.

Skull of type and ♀ from Elgon: condylo-incisive length 19·6, 19·4; greatest breadth 9, 8·7; least interorbital breadth 4·3, 4·3; length of palate 8·3, 7·8; postpalatal length 9, 9; greatest maxillary breadth 5·9, 6; median depth of brain-case 4·6, 4·8; length of upper tooth-row 8·2, 8.

Dimensions of two topotypes (preserved in spirit) and two specimens from Mt. Elgon (measured in the flesh):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♂. Fort Hall	62	47	12·7
♀. " "	61	47	12·4
♂. Mt. Elgon	70	—	12
♀. " "	67	45	12

Hab. Fort Hall, Kenia District, British East Africa.

Type. Adult female. B.M. no. 3. 3. 2. 7.

The small series of skins in the collection shows that there is a certain amount of colour-change due to bleaching, the new pelage being rather darker and browner than the old worn fur.

Externally this shrew is distinguished from *jacksoni* by its brighter, more cinnamon-coloured coat, slender, almost hairless tail, and its lighter underparts. From *gracilipes* it may be distinguished by its rather smaller and flatter skull and smaller teeth.

(96) *Crocidura hildegardeæ procera*, Hell.

Crocidura hildegardeæ procera, Heller, Smith. Misc. Coll. vol. lx. no. 12, p. 10 (1912).

Size of body much as in *hildegardeæ*, with lighter grey-underparts more distinctly marked off from the brownish tint of the dorsal surface.

Heller describes the coloration as follows:—"Dorsal colour broccoli-brown, the colour uniform to lower sides, where it is fairly well defined against the light grey underparts; hair everywhere plumbeous at base; feet white; ears drab; tail indistinctly bicolor, broccoli-brown above, drab-grey below." In the Museum Collection is a specimen from Baringo which undoubtedly represents this race. The colour of this individual is rather brighter than in true *hildegardeæ*, the dorsal surface being rather more cinnamon, near "snuff-brown" speckled with "neutral grey." The cold light grey belly is considerably more sharply differentiated from the brown dorsal surface than in the Fort Hall form. Backs of hands and feet dirty white. Tail rather paler below than in *hildegardeæ*, but not nearly as light as in the Uganda race.

Skull a trifle larger, with rather larger teeth, but of the same flattened type; in the Baringo specimen the brain-case is rather broader than in *hildegardeæ*.

Dimensions of the type (as given by Heller):—

Head and body 72 mm.; tail 51; hind foot 12.

Skull: condylo-incisive length 20; greatest breadth 9; length of upper tooth-row 8 8.

Skull-dimensions of a female from Baringo:—

Condylo-incisive length 20·5 mm.; greatest breadth 9·5; least interorbital breadth 4·2; length of palate 8·4; post-palatal length 9·8; greatest maxillary breadth 6·5; median depth of brain-case 4 8; length of upper tooth-row 8·4.

Hab. Mt. Lololokui, Northern Guaso Nyiro District, British East Africa. Altitude 6000 feet.

Type. Adult female. U.S. Nat. Mus. no. 181820.

The rather lighter coloration, more distinctly differentiated ventral and dorsal surfaces, and rather larger teeth separate this race from *hildegardeæ*. The lighter colour, less bicolored tail, and rather larger skull separate it from the Uganda race described below.

(97) *Crocidura hildegardeæ rubecula*, subsp. n.

Very like true *hildegardeæ*, but with lighter underparts and more hairy and more distinctly bicolor tail.

General colour of dorsal surface of new pelage dark brown (between "mummy-brown" and "sepia"); in the bleached condition the coat is dull cinnamon-brown. Ventral surface distinctly lighter, more silvery. Hands and feet as in the Fort Hall form. Tail more thickly haired and very much lighter below, ventral surface pure white.

Skull and teeth as in *hildegardeæ*.

Dimensions of the type (measured in the flesh):—

Head and body 73 mm.; tail 45; hind foot 14·5; ear 9.

Skull: condylo-incisive length 19·1; greatest breadth 8·6; least interorbital breadth 4·3; length of palate 7·6; greatest maxillary breadth 6; median depth of brain-case 4·9; length of upper tooth-row 8 3.

Hab. Kigezi, S.W. Uganda. Altitude 6000 feet.

Type. Adult male. B.M. no. 11.12.3.54. Original number 2035. Collected on April 25th, 1911, by Mr. Robin Kemp.

The only other specimen of this form obtained by Mr. Kemp is immature, being rather greyer in colour, but possessing a very similarly coloured tail, the hairs on the ventral surface being pure white. From *procera* this Uganda race may be distinguished by its rather darker coloration, smaller skull and teeth, and the white underside of the tail. The lighter and more silvery underparts and pure white hairs on the ventral surface of the tail separate this form from true *hildegardeæ*.

(98) *Crocidura hildegardeæ altæ*, Hell.

Crocidura hildegardeæ altæ, Heller, Smith. Misc. Coll. vol. lx. no. 12, p. 9 (1912).

Related to *hildegardeæ*, but darker in colour and with longer tail.

Size of hind foot a trifle larger.

Colour of upper surface vandyke-brown, the brown tint merging imperceptibly on the flanks into the slightly lighter drab-coloured underparts. Backs of hands and feet drab. Tail long, uniform dark brown, only slightly lighter on underside basally.

Skull about equal in size to that of *hildegardeæ*, teeth slightly larger.

Dimensions of the type (as given by Heller):—

Head and body 74 mm.; tail 62; hind foot 13·5.

Skull: condylo-incisive length 19·8; greatest breadth 9·2 length of upper tooth-row 8·7.

Hab. Mt. Gargues, British East Africa. Altitude 6000 feet.

Type. Adult male. U.S. Nat. Mus. no. 181819.

The longer tail and much darker dorsal and ventral surface readily separate this race from the allied forms.

(99) *Crocidura planiceps*, Hell.

Crocidura planiceps, Heller, Smith. Misc. Coll. vol. lvi. no. 15, p. 5 (1910)

Darker than *hildegardeæ*, with smaller and flatter skull.

Size of body much as in *hildegardeæ*. Fur short, hairs on back about 2·5 mm. in length. Colour "above uniform seal-brown, this colour carried well down on the sides, where it merges gradually into the lighter smoky grey of the underparts. Tail seal-brown like the upper parts. Feet somewhat lighter brown than the back. Lateral glands distinctly marked by an oblong patch of whitish hair." The hairs of the back are stated to be "uniform in colour to the roots," and on the under surface "showing a narrow basal band of plumbeous."

Skull with very flat brain-case, depressed anteriorly.

Dimensions of the type (as given by Heller):—

Head and body 71 mm.; tail 53; hind foot 12·3.

Skull: condylo-incisive length 18 3; greatest breadth 8; length of upper tooth-row 8.

Hab. Rhino Camp, Lado Enclave.

Type. Adult male. U.S. Nat. Mus. no. 161611.

The darker colour and smaller skull, with depressed brain-case, distinguish this species from *hildegardeæ* and its allies.

(100) *Crocidura somalica*, Thos.

Crocidura somalica, Thomas, Ann. & Mag Nat. Hist. (6) vol. xvi. p. 52 (1895).

Rather smaller than *hildegardeæ*, with shorter tail.

Size of body small, hind foot rather shorter than in *hildegardeæ*. Fur of medium length, hairs of back 4–5 mm. long.

Colour of back (from spirit-specimens) slate-grey washed with brown, passing gradually on the flanks into the dull greyish white of the ventral surface. Backs of hands and feet white. Tail shorter than in *hildegardeæ* and rather thicker at its base, brown above, white below; bristle-hairs numerous, evenly distributed throughout nearly the whole length of the tail.

Skull about equal in length to that of the Fort Hall species, brain-case equally flat but narrower. Teeth similar, second and third upper unicuspids almost equal in size.

Dimensions of the type (in spirit):—

Head and body 53 mm.; tail 40; hind foot 11·2.

Skull: condylo-incisive length 19·4; greatest breadth 8·6; least interorbital breadth 4; length of palate 7·8; post-palatal length 8·5; greatest maxillary breadth 5·8; median depth of brain-case 4·2; length of upper tooth-row 8·5.

Hab. Webi Shebeli, Somaliland.

Type. Adult female. B.M. no. 93. 6. 30. 7.

In addition to the type, there is in the Collection a male specimen, collected near the type-locality, which agrees very closely in general body- and skull-dimensions.

(101) *Crocidura crossei*, Thos.

Crocidura crossei, Thomas, Ann. & Mag. Nat. Hist. (6) vol. xvi. p. 53 (1895).

A member of the *hildegardeæ* group.

About equal in size to *somalica*, but with longer tail. Fur rather short, hairs of back 3–4 mm. in length.

Colour (from spirit-specimen) slaty grey tinged with brown, paler and greyer below. Lateral glands whitish. Backs of hands and feet dirty brownish buff; digits rather paler, almost white. Tail long and fairly stout, finely haired, brownish grey above, dirty white below; bristle-hairs numerous, evenly distributed throughout nearly the whole length.

Skull about equal in length to that of *somalica*, brain-case equally flat but narrower. Teeth a trifle smaller, upper unicuspids narrower.

Dimensions of the type (in spirit):—

Head and body 60 mm.; tail 51; hind foot 12; ear 7·5.

Skull: condylo-incisive length 19·3; greatest breadth 8·2; least interorbital breadth 3·7; length of palate 8·1; post-palatal length 8·9; greatest maxillary breadth 5·6; median depth of brain-case 4·3; length of upper tooth-row 8·3.

Hab. Asaba, 150 miles up the Niger.

Type. Adult male. B.M. no. 95. 5. 3. 4.

Group 18 (*allex* and *alpina*).

Size very small. Colour above dark sepia or brownish red, below greyish buff. Fur normal in length. Second and third upper unicuspids about equal in size.

(102) *Crocidura allex*, Osg.

Crocidura allex, Osgood, Field Mus. Nat. Hist. Publication 143 (Zool. Ser.), vol. x. no. 3, p 20 (1910).

Almost equal in size to *b. cuninghamei*, with shorter skull, higher brain-case, and slightly smaller teeth.

Fur much longer than in *bicolor* and its allies, more as in the *hildegardeæ* group. Colour of dorsal surface dull brown (near "sepia"), very much as in *j. amalæ*; flanks rather more strongly tinged with buff, the brown tint passing fairly abruptly into the greyish buff of the ventral surface. Backs of hands and feet greyish or greyish buff. Tail slender and finely haired, almost naked in general appearance; dark brown above, rather lighter below. Caudal bristle-hairs normal.

Skull a trifle shorter than in *cuninghamei*, with a higher brain-case, more as in *bottegi*, but larger and with larger teeth; second and third upper unicuspids about equal in size, but overlapping.

Dimensions of the type (as given by Osgood) :—

Head and body 64 mm.; tail 45 ; hind foot 12.

Skull : condylo-incisive length 17·1 ; greatest breadth 7·7 ; postpalatal length 7·9; greatest maxillary breadth 5·2; length of upper tooth-row 7·15.

Hab. Naivasha, British East Africa.

Type. Adult male. Field Mus. Nat. Hist. no. 16820.

In the Museum Collection there is a single specimen from near Lake Olbollossat, collected and presented by A. Blayney Percival, Esq , which agrees fairly closely with Osgood's description ; the flesh-dimensions of this individual are given as :—Head and body 55 mm. ; tail 38 ; hind foot 11 ; ear 7.

From its near neighbour, *bicolor cuninghamei*, this Naivasha species is distinguished externally by its much longer fur and browner colour ; the skulls are very distinct, that of *allex* being very much higher and with a more rounded brain-case. The following species, *alpina*, from

Mt. Kenia, is considerably brighter in colour and possesses a slightly flatter skull, with the second upper unicuspid smaller in size.

(103) *Crocidura alpina*, Hell.

Crocidura alpina, Heller, Smith. Misc. Coll. vol. lvi. no. 9, p. 5 (1910).

Closely allied to *allex*, from Naivasha, but with flatter skull and the second upper unicuspid rather smaller.

General dimensions much as in *allex*.

Colour of upper parts, in the new unbleached pelage, yellowish brown, near "Prout's brown," gradually changing on the flanks to the buffy grey of the ventral surface. In the old bleached coat the colour is very much more orange. Underparts grey washed with pinkish buff. Backs of hands and feet pale brownish. Tail covered with very short fine hairs, dark brownish above, paler below, but not sharply bicoloured; bristle-hairs not very numerous or conspicuous.

Skull shorter and flatter than in *allex*, but not as flat as in the *bicolor* group; second upper unicuspid relatively smaller.

Dimensions of the type (as given by Heller):—

Head and body 65 mm.; tail 39; hind foot 11.

Skull: condylo-incisive length 16·2; greatest breadth 7·5; depth of skull at bullæ 4·6; length of upper tooth-row 7.

In the Museum Collection there is a specimen from Solai, Kenya (8000 feet), which undoubtedly represents this species; the flesh dimensions are given as:—Head and body 63 mm.; tail 41; hind foot 11; ear 8.

Hab. West slope of Mt. Kenya, British East Africa. Altitude 10,000 feet.

Type. Adult female. U.S. Nat. Mus. no. 163089.

The brighter colouring, rather smaller and flatter skull, and smaller size of the second upper unicuspid distinguish this Kenya shrew from the Naivasha *allex*. The members of the *bicolor* group are at once distinguished from *alpina* by their shorter fur, flatter skulls, and much greyer colour.

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

June 23rd, 1915.—Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The following communications were read :—

1. 'On a New Eurypterid from the Belgian Coal Measures.' By Prof. Xavier Stainier.

In this paper the Author records the discovery of a specimen of a new *Eurypterus* in the cores of a trial-boring for coal in Belgium. He describes the fossil, which is in a very satisfactory state of preservation. To allow of comparisons, a short description of the eleven Carboniferous species known up to the present is appended. The nearest form to the Belgian fossil seems to be a Pennsylvanian *Eurypterus*, which nevertheless is not identical with the former. The Author then discusses the geological range and the evolution in time of the twelve Carboniferous Eurypterids. The paper ends with a short literature of the subject.

2. 'On a Fossiliferous Limestone from the North Sea.' By Richard Bullen Newton, F.G.S.

The material on which this paper is based was trawled from the floor of the North Sea, some 100 miles N.E. ½ N. of Buchan Ness, and was forwarded to the British Museum (Natural History) by Mr. R. D. Thomson, of Aberdeen. It presents no appearance of glaciation, so that its occurrence *in situ* seems to be highly probable. There is no record of a similar limestone from either England or Scotland. It is of highly siliceous character and full of marine shells, of which the Pelecypoda are the more prominent; there are, also, occasional fragments of wood in contact with the limestone which, from a preliminary examination, appear to show coniferous characters. Some 23 species of mollusca have been determined, all of which exhibit a southern facies, including 10 gastropods and 13 pelecypods: the latter embrace a new Dosiniform shell belonging to the genus *Sinodia*, the relationships of which are entirely confined to the Indian Ocean regions of Southern Asia. Eighteen of the species, or about 80 per cent., trace their origin from the Vindobonian stage of the Miocene; ten, or about 40 per cent., may be regarded as extinct; whereas twelve, or 50 per cent., still exist in recent seas. The majority of the species are fairly evenly distributed in both the Coralline and the Red Crag formations of East Anglia, although, on account of so large a number being extinct, and bearing in mind their southern facies, it is thought that the rock must be of older age than Red Crag. Additional support is given to this view, because such shells as *Arcoperna sericea*, *Tellina benedeni*, and *Panopæa menardi* are not known of later age in this country than the Coralline Crag. The occurrence also of the extinct gastropods *Streptochetus sexcostatus* and *Ficus* [*Pyrula*] *simplex*, which are particularly characteristic of the Upper Miocene or Messinian deposits of Northern Germany, constitutes further evidence in favour of a greater antiquity for this limestone than that of the Red Crag: it is, therefore, considered to be of Coralline Crag age.

INDEX TO VOL. XVI.

ACANTHOCERA, new species of, 16
Actenia, new species of, 400
Adolias, new species of, 173
Adoretus, on new names for species of, 232
Æthiopana, definition of the new generic name, 191
Æthomys, characters of the new subgenus, 477
Alæna, new species of, 186
Annelida, new, 449
Anomala, on new names for species of, 231.
Antitype, new species of, 251
Anumeta, new species of, 257.
Aphantopus, new species of, 172
Aprotodon, characters of the new genus, 408.
Argyrocheila, new species of, 189.
Arnoglossus, new species of, 108.
Arpactus, new species of, 287
Arrow, G J., on the nomenclature of certain species of ruteline coleoptera, 231, on a new genus of lamellicorn beetles from Borneo, 317, on species of Rhopæa from the Fiji Islands, 319.
Arvicanthis, new subspecies of, 479.
Astictopterus, new species of, 177.
Austroagrion, new species of, 106.
Bahora, new species of, 170.
Baylis, H A, on a new cestode, 40; on a trematode from Protopterus, 85; on two new species of Monhystera, 414; on a new African earthworm, 449
Batrachia, new, 402.
Bazania, new species of, 396.
Bombus, on the Australian species of, 434
Bethune-Baker, G T., on new species of lepidoptera from Africa and the East, 180
Boarmia, new species of, 185.
Books, new —An Index to the Museum Boltenianum, 232
Borradaile, L. A., on the species of Lucifer and their distribution, 226
Boulenger, G A, on two new lizards from Australia, 64, on a new tree-frog from Dutch New Guinea, 402
Cænoprosopon, characters of the new genus, 267.
Campion, H, on a new agrionine dragonfly from Northern Australia, 105
Cannomys, characters of the new genus, 57, new species of, 316.
Cardisoma guanhumi, on a new parasite from, 414.
Cardium, new species of, 169.
Casbia, new species of, 195.
Catasticta, new species of, 412.
Centrochares, new species of, 328.
Cephalodiscus gilchristi, observations on, 283.
Cestoda, new, 40.
Champion, G. C, on the Xylophilidæ of Ceylon, 215.
Chilena, new species of, 249.

Chimæra monstrosa, on an abnormality in the mandibular arch of, 110.
Chloroclystis, new species of, 193.
Chogada, new species of, 184.
Christophia, new species of, 397.
Chrysocraspeda, new species of, 192.
Chrysops, new species of, 265.
Cirphis, new species of, 179.
Cockerell, T. D. A., descriptions and records of bees, 1, 96, 482.
Coleoptera, new, 54, 215, 317, 319; on the nomenclature of species of ruteline, 231.
Collinge, W. E., on an abnormality in the mandibular arch of Chimæra monstrosa, 110; on Idotea hectica, 162.
Columbella, new species of, 165.
Conchology, on some enigmatical names in, 328.
Corizoneura, new species of, 37.
Corone, new species of, 176.
Cortyta, new species of, 255.
Corvira, characters of the new genus, 310.
Cottus scorpius, on some parasites of, 383.
Crepidula fornicata, on the occurrence of, on the East Coast of England, 496.
Crocidura, new species of, 66, 126, 357, 506.
Crustacea, new, 336.
Cultripalpa, new species of, 182.
Cunnington, Dr. W. A., on the Entomostraca of the Albert Nyanza, 80.
Cyclosia, new species of, 177.
Day, H., on the parasphenoid of a palæoniscoid, 421.
Deilemera, new species of, 177.
Demanga, new species of, 494.
Demoplatus, characters of the new genus, 269.
Deomys, new species of, 150.
Diala, new species of, 167.
Diatomineura, new species of, 34.
Dichogaster, new species of, 451.
Diptera, new, 16, 203, 259, 502.
Discoidea cylindrica, on the periproctal plates of, 499.
Distant, W. L., on some Australian Cicadidæ, 50; rhynchotal notes, 322, 489.
Dollman, G., on the African shrews belonging to the genus Crocidura, 66, 124, 357, 506.
Donax, new species of, 170.
Drillia, new species of, 164.
Ectropis, new variety of, 196.
Edwards, F. W., on three new species of Olbiogaster, 502.
Elporia, characters of the new genus, 204.
Elymnias, new species of, 171.
Entomostraca of the Albert Nyanza, on the, 80.
Epimys, new subspecies of, 149.
Epitola, new species of, 190.
Erebus, new species of, 179.
Erephopsis, new species of, 26.
Ericia, new species of, 180.
Erinaceus, new subspecies of, 152.
Eublemma, new species of, 252.
Eupleres, note on the genus, 318.
Euselasia, new species of, 412.
Euxylophilus, characters of the new genus, 215.
Evenus, new species of, 174.
Fishes, new, 108; on some Protozoa from, 381.
Forster-Cooper, C., on new genera and species of mammals from the miocene deposits of Baluchistan, 404.
Fossa, note on the genus, 346.
Funisciurus, new subspecies of, 146.
Galidia, on the external characters of, 351; G. elegans, note on, 123.
Galidictis, on the external characters of, 351, on the species of the genus, 113.
—— vittatus, on the name of the species described by Gray as, 505.
Gargara, new species of, 489.
Gastropacha, new species of, 199.
Gecarcinus ruricola, on new parasite from, 414.
Gelocus, new species of, 406.
Geological Society, proceedings of the, 515.
Gilchrist, Dr. J. D. F., on Cephalodiscus gilchristi, 233.
Grammomys, characters of the new genus, 150.
Hæmogregarina cotti, notes on, 383.
Halictus, new species of, 4, 98, 488.
Harmer, Dr. S. F., on Cephalodiscus gilchristi, 243.
Harpiola, characters of the new genus, 309.
Hastina, new species of, 193.

Hemidromodes, new species of, 392.
Hemigalago, new subspecies of, 466.
Hemigalus derbyanus, on the external characters of, 153.
Hemimastodon crepusculi, note on the dentition of, 409.
Heterographis, new species of, 399.
Heterorchis, characters of the new genus, 95.
Hewitsonia, new variety of, 190.
Hibrildes, new species of, 198.
Hippoglossoides, on the Pacific species of, 299.
Homoptera, new, 50, 322, 489.
Hybandoides, characters of the new genus, 327.
Hyla, new species of, 402.
Hymenoptera, new, 1, 96, 286, 413, 446, 482; notes and synonymy of, in the collection of the British Museum, 331.
Hypocala, new species of, 181.
Hypochrosis, new species of, 195.
Hypolimnas, new species of, 173.
Idotea hectica, remarks on, 162.
Jamides, new species of, 175.
Kathepyris, new species of, 295.
Lebedodes, new species of, 199.
Lepidoptera, new, 170, 186, 247, 392, 411.
Lewis, G., on new species of Histeridæ, 54.
Linsang, on the external characters of the genus, 341.
Liptena, new species of, 189.
Liptenara, characters of the new genus, 186.
Littorina, new species of, 167.
Lotorium, new species of, 165.
Lucifer, new species of, 228.
Lygosoma, new species of, 64.
Machilidæ, notes on the British, 10.
Macoma, new species of, 169.
Mammals, new, 56, 61, 66, 116, 124, 146, 310, 313, 357, 404, 447, 465, 509.
Mangosia, new species of, 201.
Mastomys, characters of the new subgenus, 477.
Meade-Waldo, G., notes and synonymy of hymenoptera in the collection of the British Museum, 331.
Megachile, new species of, 488.
Melampsalta, new species of, 50.
Melanitis, new species of, 172.
Melissodes, new species of, 482.
Mesotrichia, new variety of, 3.
Metasia, new species of, 402.
Micropentila, new species of, 189.
Milionia, new species of, 191.
Mimochroa, new species of, 183.
Minolia, new species of, 167.
Modiola, new species of, 84.
Mollusca, new, 84, 164; on some enigmatical names among the, 328.
Monhystera, new species of, 414.
Morley, C., notes and synonymy of hymenoptera in the collection of the British Museum, 331.
Mungotictis, characters of the new genus, 120.
—— lineatus, definition of the new specific name, 505.
Mylomys, new species of, 148.
Myomys, characters of the new subgenus, 477.
Myopterus, new species of, 469.
Myrioblephara, new species of, 197.
Myrteta, new species of, 182.
Narosana, characters of the new genus, 200.
Natica, new species of, 166.
Nematodes, new, 414.
Nephopteryx, new species of, 395.
Neritine, note on the generic name, 328.
Neuroptera, new, 105.
Newton, R. B., on a fossiliferous limestone from the North Sea, 515.
Nomincia, new species of, 296.
Nomioides, new species of, 487.
North, F. J., on the periproctal plates of Discoidea cylindrica, 499.
Nyctocleptes, new species of, 58.
Odonestis, new species of, 178.
Oidemaskelis, characters of the new genus, 201.
Olbiogaster, new species of, 502.
Olivella, new species of, 165.
Osmia, new species of, 483.
Oxyrhachis, new species of, 322.
Pachypasa, new species of, 199.
Panope, note on the generic name, 329.
Parabrachyodus, characters of the new genus, 404.
Paracolletes, new species of, 103.
Paradromalia, new variety of, 196.
Parasphecodes, new species of, 90.
Pecten, new species of, 168.

Pentadactylus, new species of, 166.
Pentila, new species of, 187.
Pepsis, new species of, 413.
Peridela, new species of, 194.
Petrobius, new species of, 11.
Petromachilis, characters of the new genus, 12.
Phoxichilus, note on the generic name, 330.
Pionea, new species of, 401.
Plecoptera, new species of, 182.
Pocock, R. I., on some of the external characters of the palm-civet and its allies, 153; on some of the external characters of the genus Linsang, with notes upon the genera Poiana and Eupleres, 341; on some external characters of Galidia, Galidictis, and allied genera, 351; on the species of Galidictis, 113; on the name of the species described by Gray as Galidictis vittatus, 505.
Poiana, note on the genus, 345.
Pomasia, new species of, 194.
Potamogale, new subspecies of, 470.
Praomys, characters of the new subgenus, 477.
Preston, H. B., on a new Modiola from Ceylon and a new Tellina from New Caledonia, 84.
Pristarthria, new species of, 399.
Promitor, characters of the new genus, 495.
Promops, new species of, 62.
Prosopis, new species of, 1, 485.
Protozoa from fishes, on some, 381.
Pseudocalvoza, characters of the new genus, 298.
Pseudopangonia, characters of the new genus, 273.
Pseudotabanus, characters of the new genus, 271.
Ptochophyle, new species of, 193.
Ptychopoda, new species of, 393.
Pycnogonology, on some enigmatical names in, 328
Pyrgauchenia, new species of, 325.
Pyrrhogyra, new species of, 411.
Raia batis, on some parasites of, 388
Rapala, new variety of, 176.
Reilly, Miss A. J., notes on the British Machilidæ, 10.
Reptiles, new, 64.
Rhadinichthys, note on the parasphenoid of a species of, 421.
Rhipidomys, new species of, 312.
Rhopæa, new species of, 320.
Rhyzomys, new species of, 59, 313.
Ricardo, Miss G., notes on the Tabanidæ of the Australian region, 16, 259.
Rissoa, note on the generic name, 329.
Robson, G. C., on the extension of the range of the American slipper-limpet on the East Coast of England, 496.
Rothschild, Lord, on lepidoptera from the Hoggar Mountains, 247, 302.
Schmidt, P., on a new flat-fish from the Black Sea, 108; on the Pacific species of Hippoglossoides, 299.
Scirrhoma, characters of the new genus, 201.
Scomber scomber, on the parasites of, 385.
Scotæcus, new species of, 447.
Scutisorex, new species of, 470.
Semiothesa, new species of, 194.
Sericia, new species of, 198.
Sharpe, Miss E. M., on three new neotropical butterflies, 411.
Silvius, new species of, 261.
Sowerby, G. B., on new species of mollusca, 164.
Sphecius, new species of, 286.
Sphecodes, new species of, 489.
Stainier, Prof. X., on a new Eurypterid from the Belgian coal-measures, 515.
Staudingeria, new species of, 397.
Stebbing, Rev. T. R. R., on some enigmatical names in conchology and pycnogonology, 328.
Stybolepis, new species of, 199.
Suastus, new species of, 176.
Swinhoe, Col. C., on new species of Indo-Malayan lepidoptera, 170.
Sylvisorex, new subspecies of, 151.
Sypna, new species of, 180.
Tabanidæ of the Australian region, notes on the, 16, 259.
Tabanus, on the New Zealand species of, 17; new species of, 284.
Tatera, new species of, 147.
Taterillus, new species of, 147.
Tellina, new species of, 84.
Terentius, new species of, 492.
Teretriosoma, new species of, 54.
Thomas, O., on the Asiatic bamboo-rats, 56, 313; on bats of the genus Promops, 61; on new African

rodents and insectivores, 146; on a special genus for Murina grisea, 309; on a new genus of phyllostome bats and a new Rhipidomys, 310; on a new bat from Northern Nigeria, 447; on mammals from the Upper Congo, 465.
Thysanura, new, 10.
Tiberianus, characters of the new genus, 493.
Tirumala, new species of, 171.
Trematoda, new, 85.
Trichodina, on a species of, from Cottus scorpius, 389.
Trigona, new species of, 2.
Turner, R. E., notes on fossorial hymenoptera, 286, 434; notes and synonymy of hymenoptera in the collection of the British Museum, 332; on a new species of Pepsis, 418.
Ulotricha, new species of, 400.
Umfilianus, characters of the new genus, 496.
Volsella, new species of, 168.
Xenaclopus, characters of the new genus, 318.
Xiphistes, new species of, 323.
Xylocopa, new species of, 8.
Xylophilus, new species of, 219.
Zelotomys, new species of, 480.
Zschokkeella, new species of, 40.

END OF THE SIXTEENTH VOLUME.

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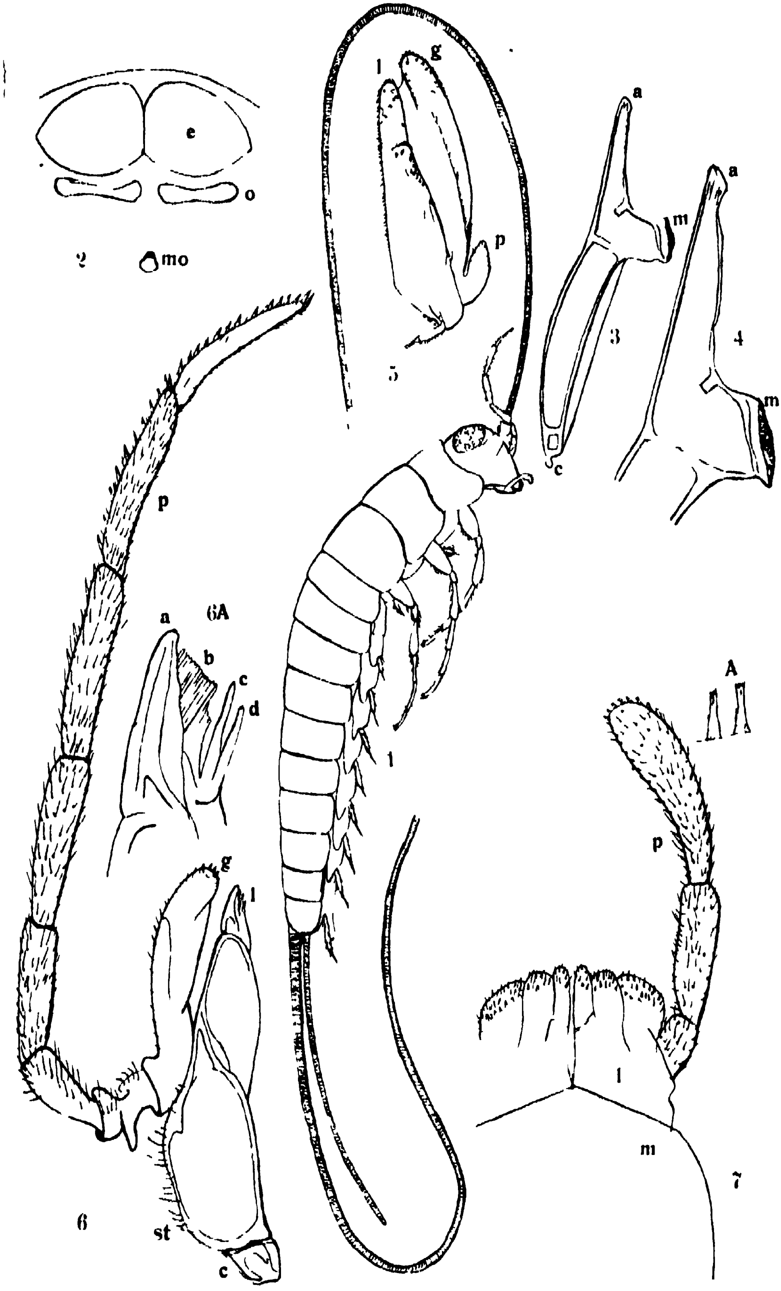

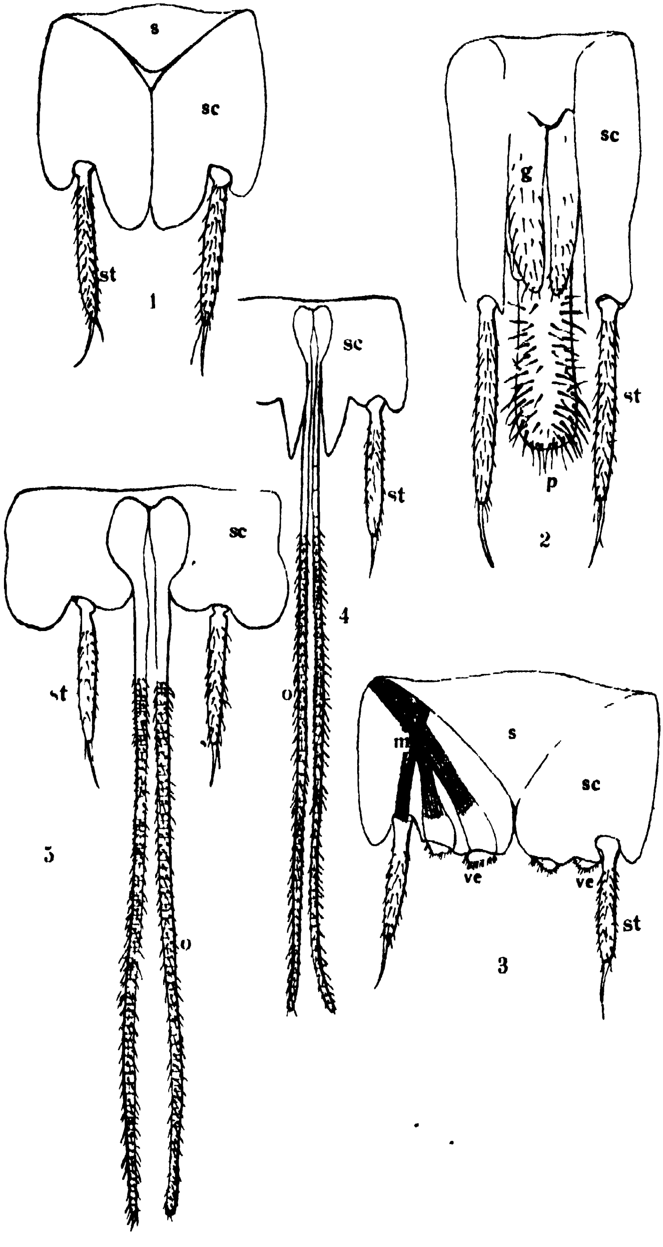
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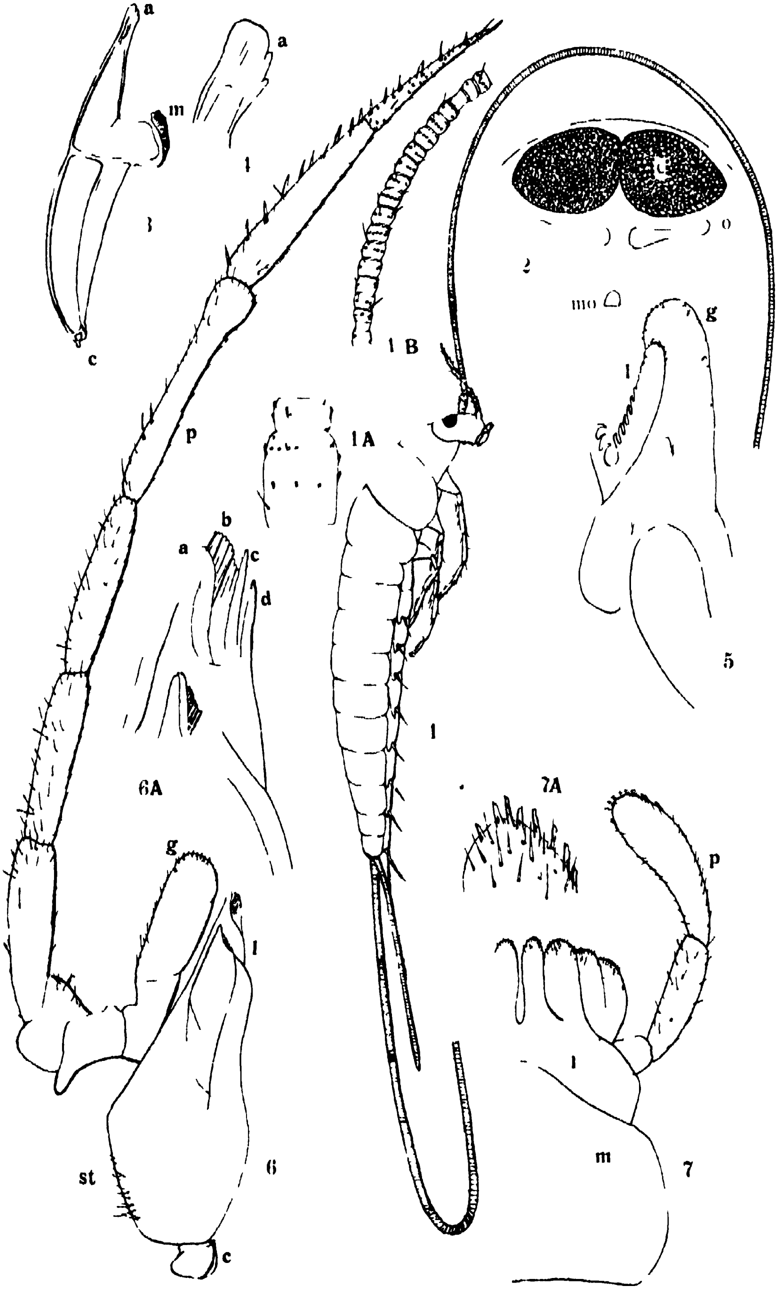

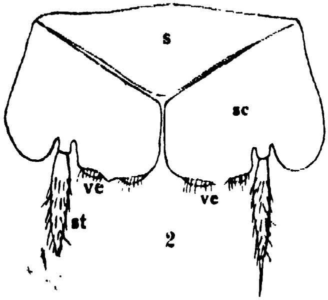
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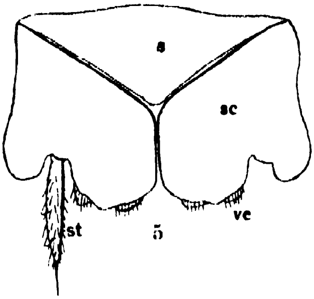
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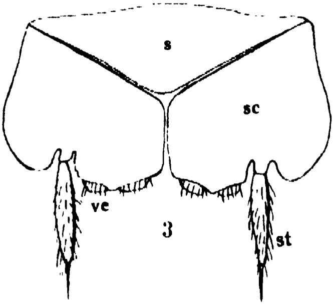
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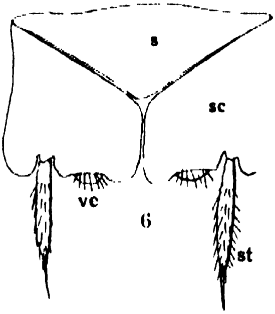
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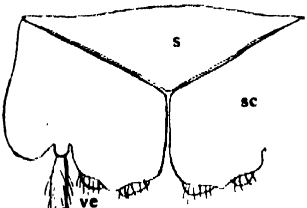
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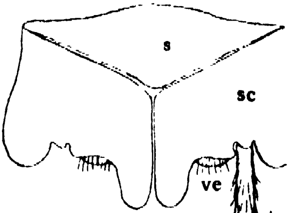
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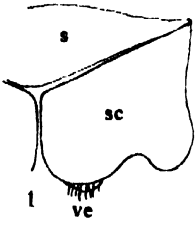
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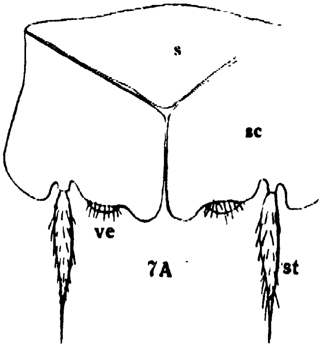
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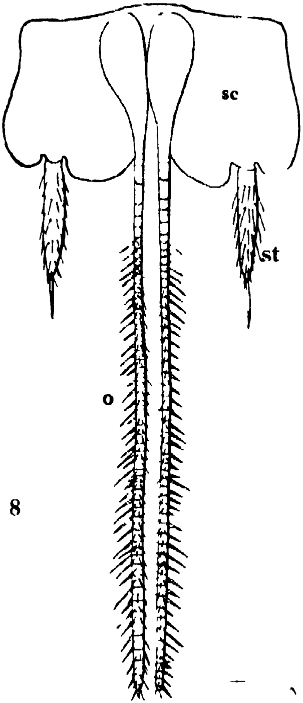

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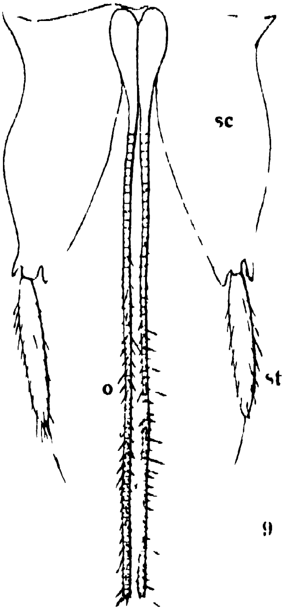

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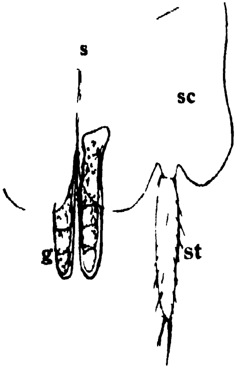

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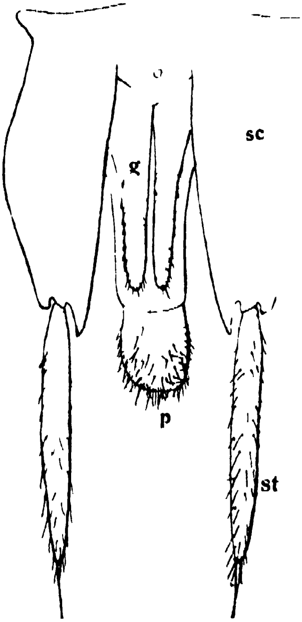

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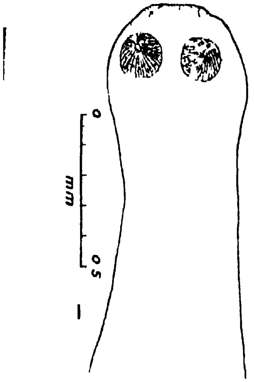

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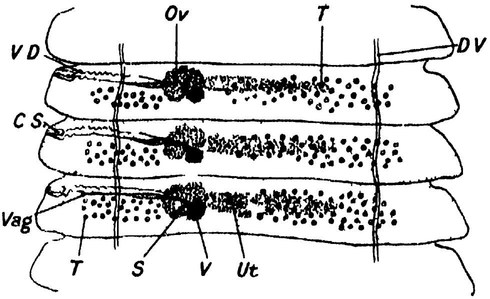

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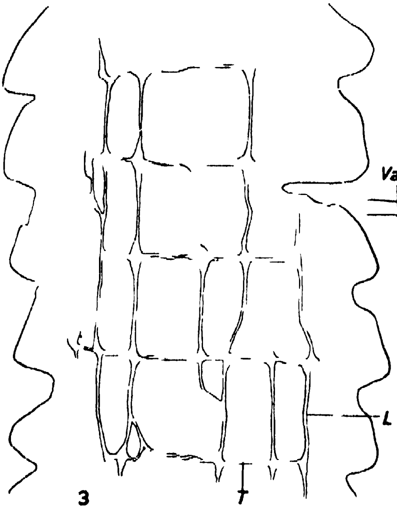

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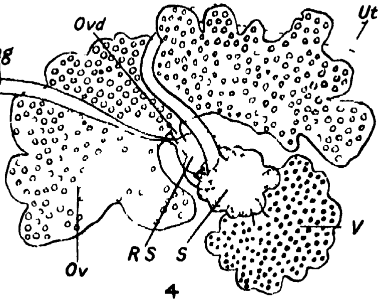

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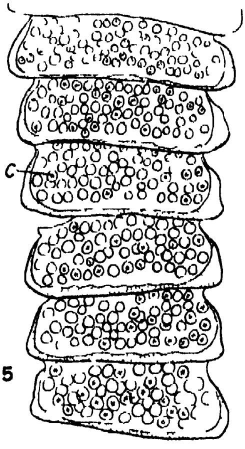

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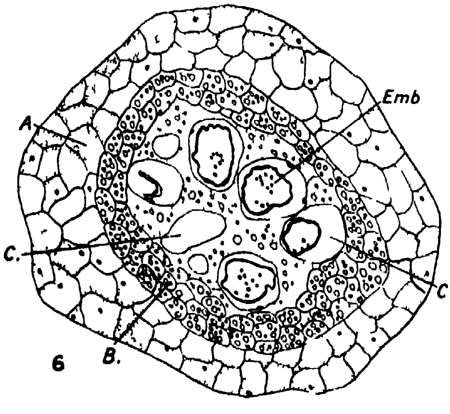

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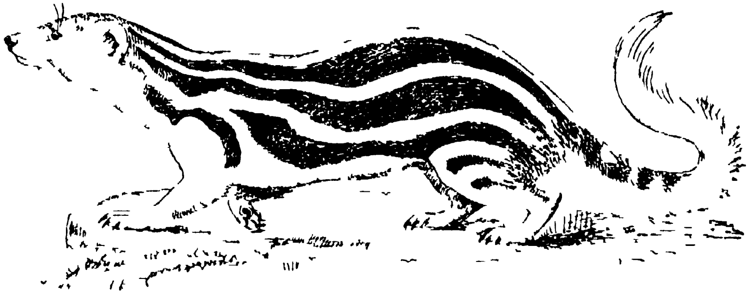

Fig. 1.—*Galidictis eximius.*

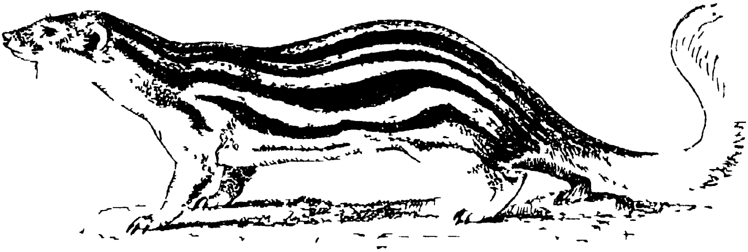

Fig. 2.—*Galidictis ornatus.*

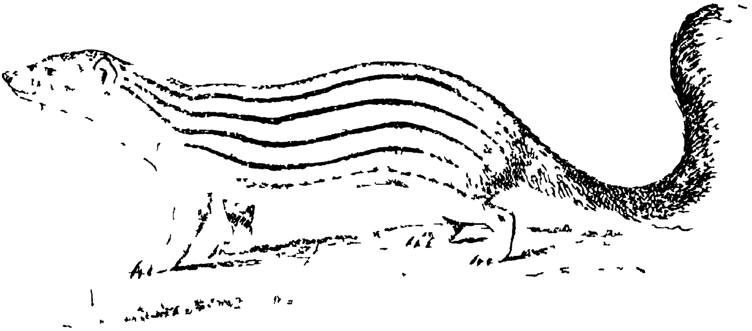

Fig. 3.—*Mungictis vittatus.*

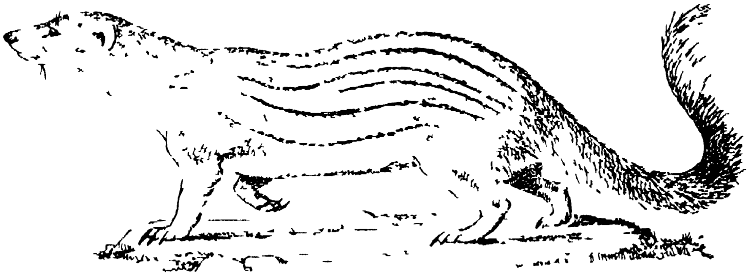

Fig. 4.—*Mungotictis substriatus.*

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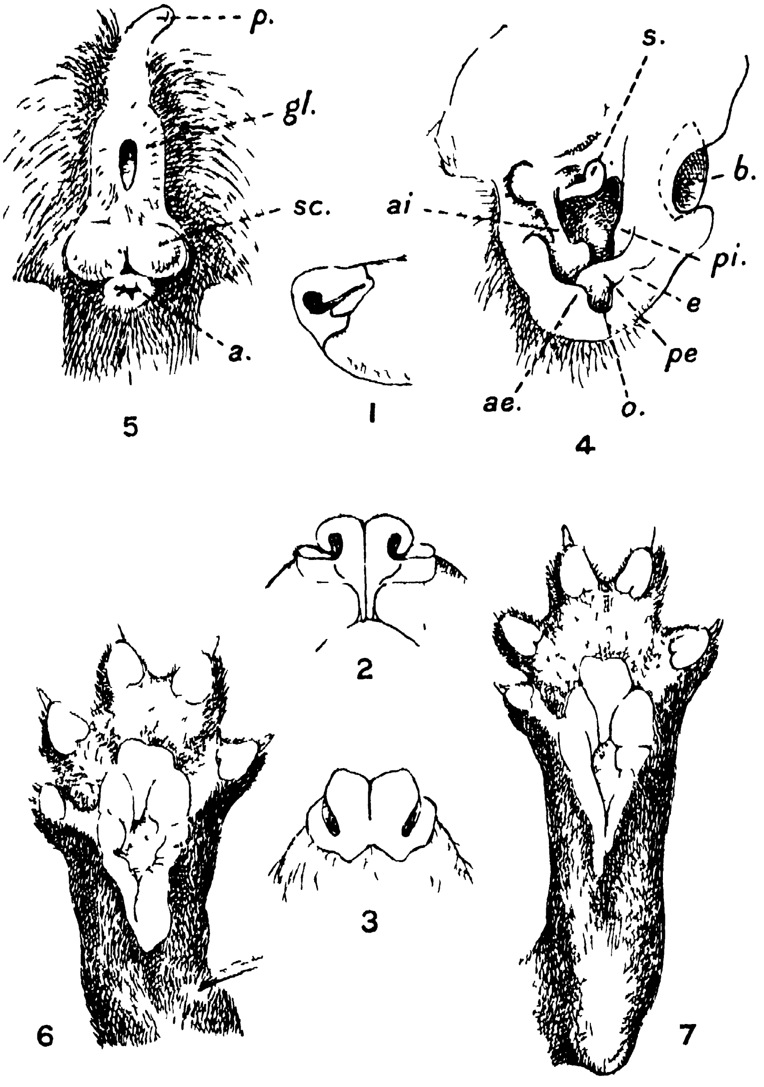

HEMIGALUS DERBYANUS

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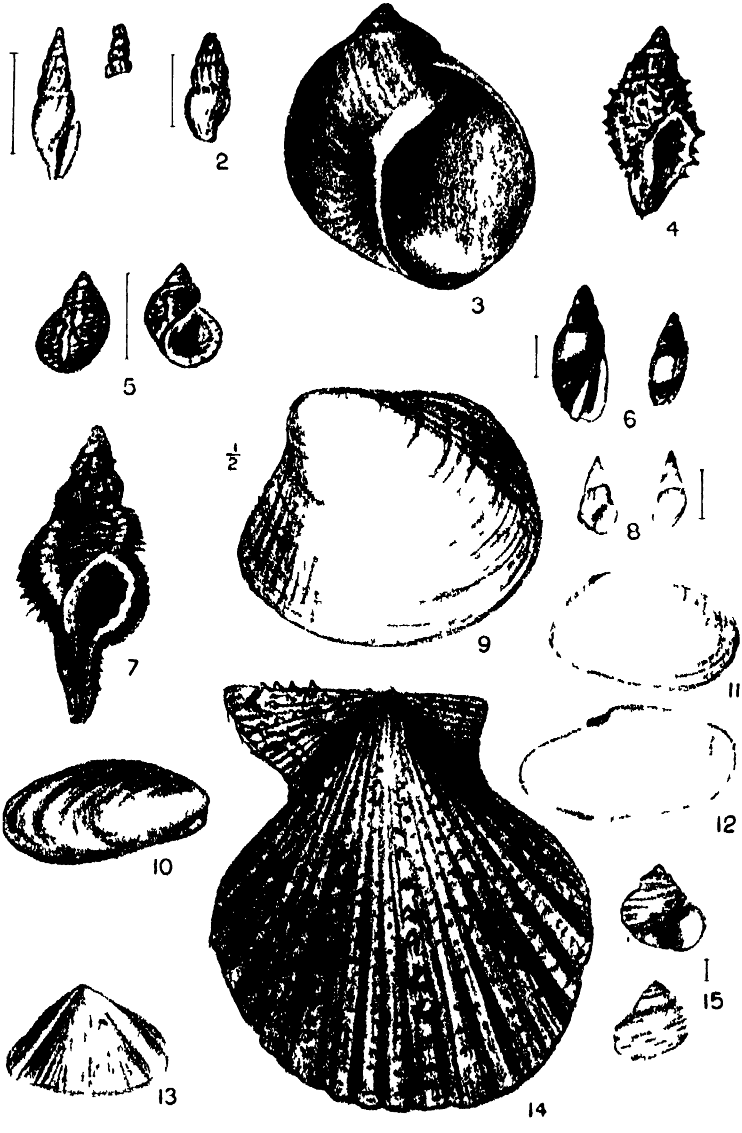
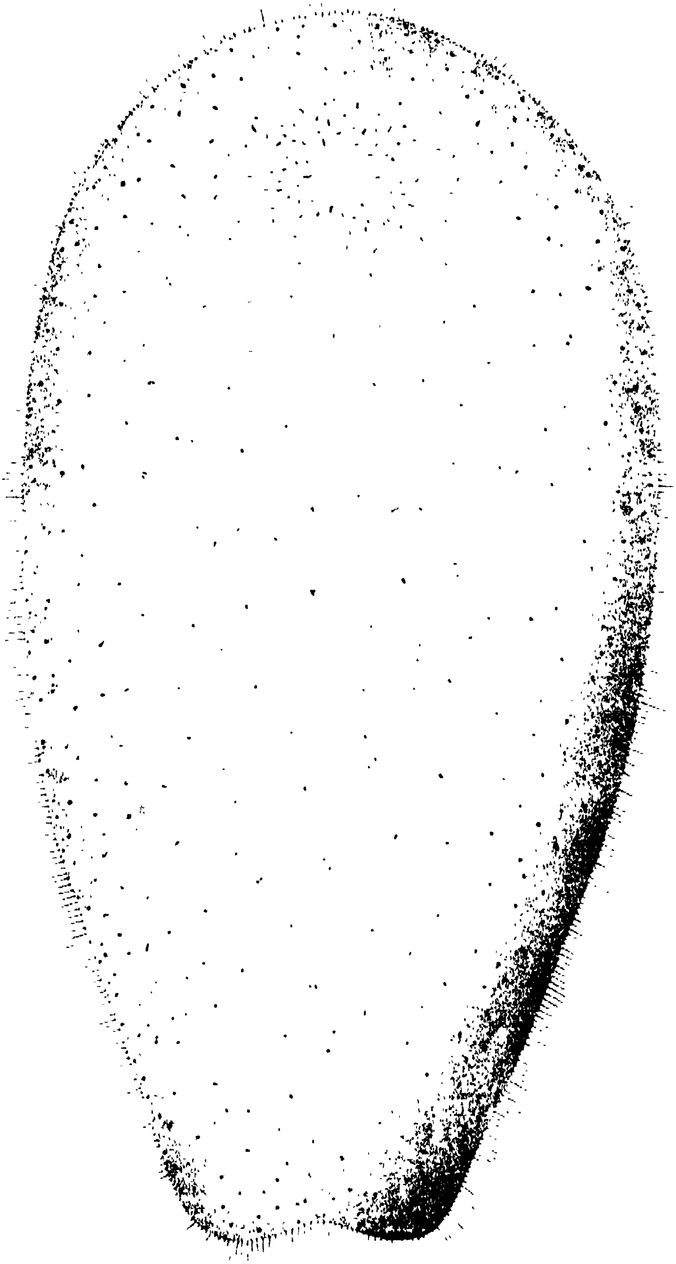
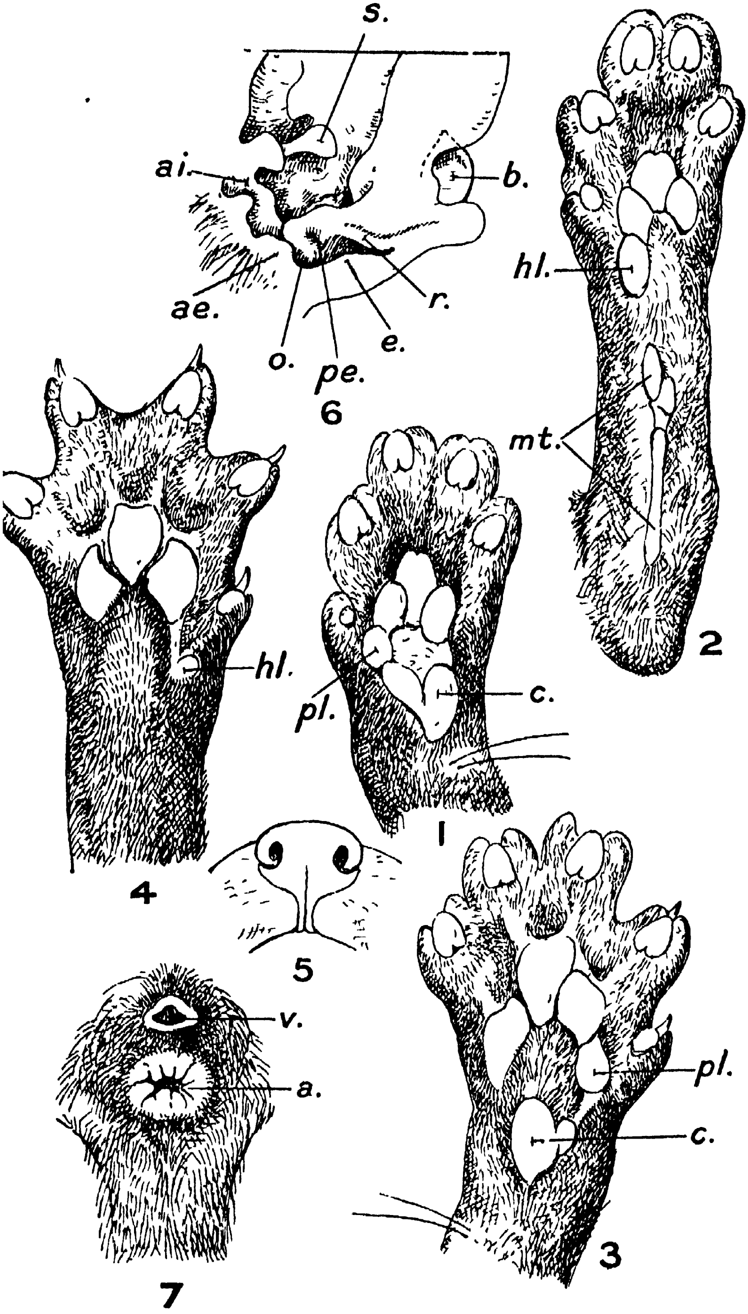
IDOTEA HECTICA (PALLAS)

SOWERBY *Ann & Mag. Nat Hist S 8. Vol XVI. Pl X.*







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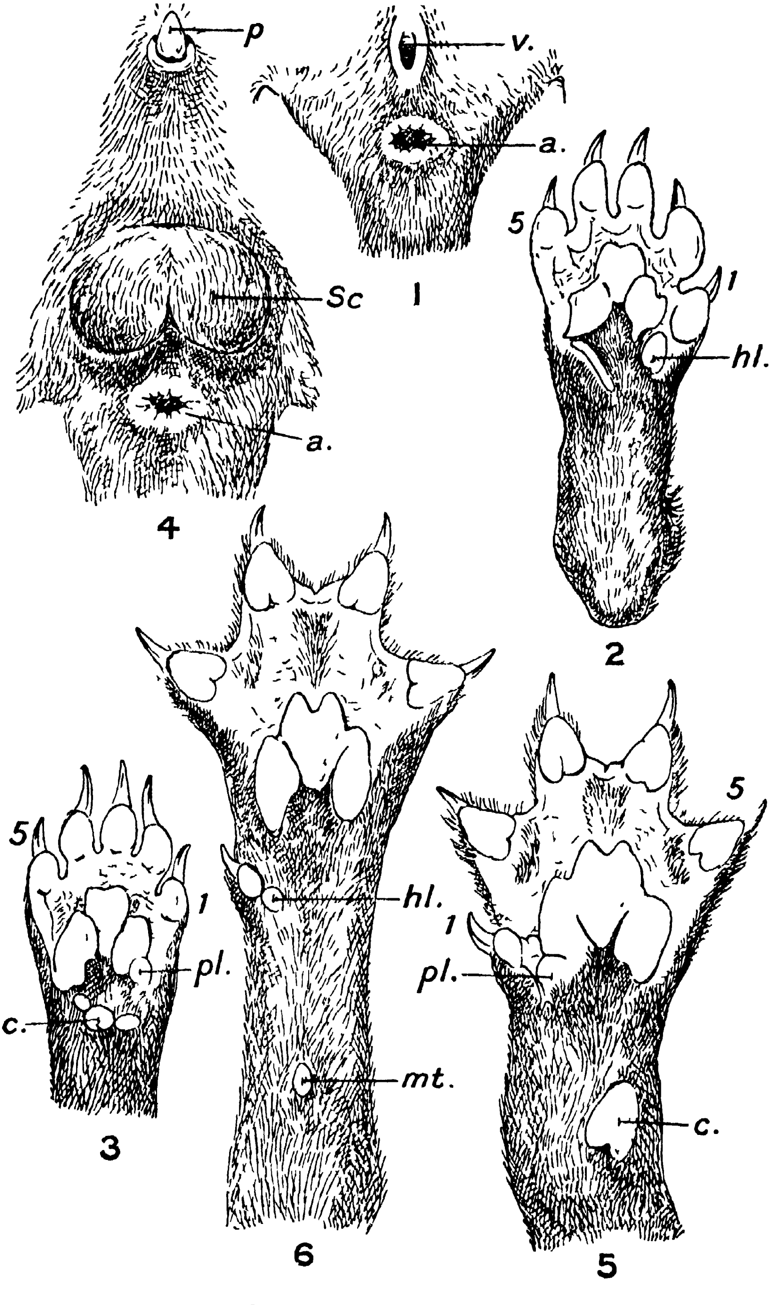

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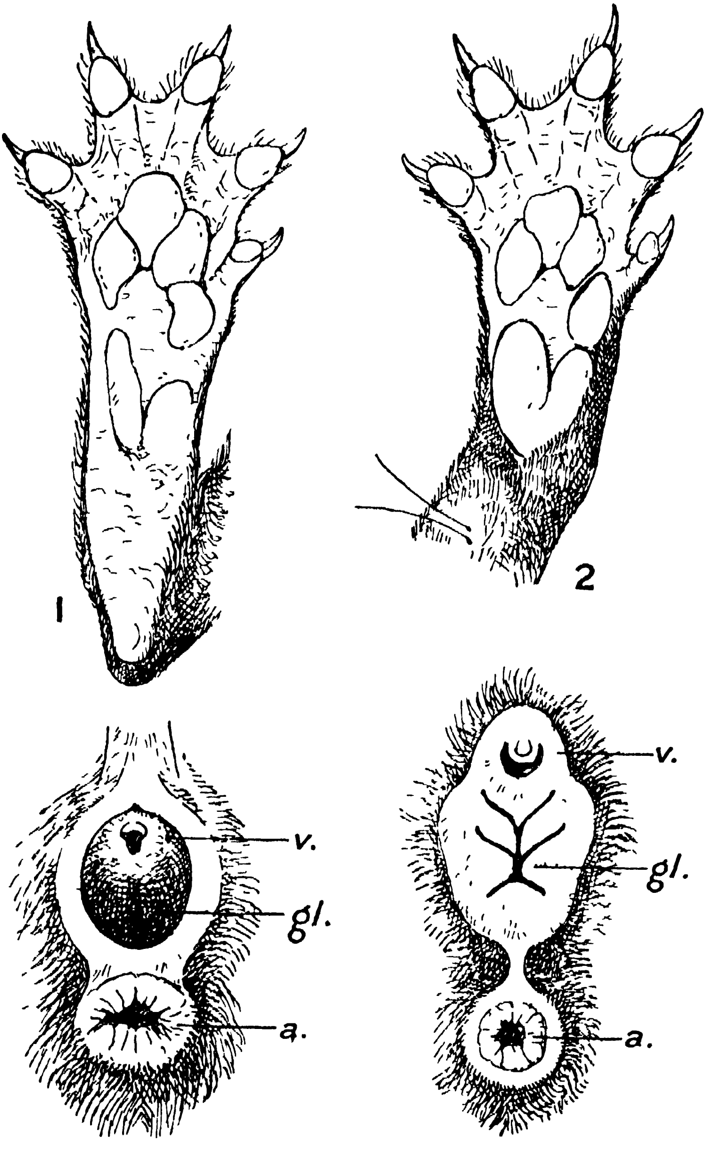

GALIDIA AND GALIDICTIS.

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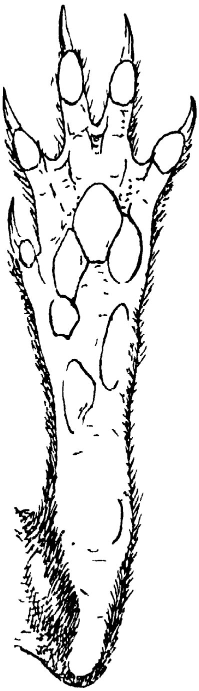

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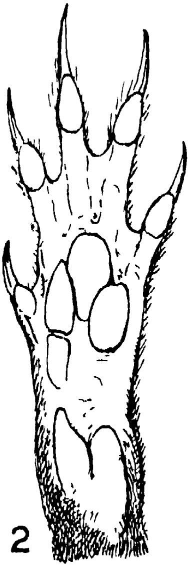

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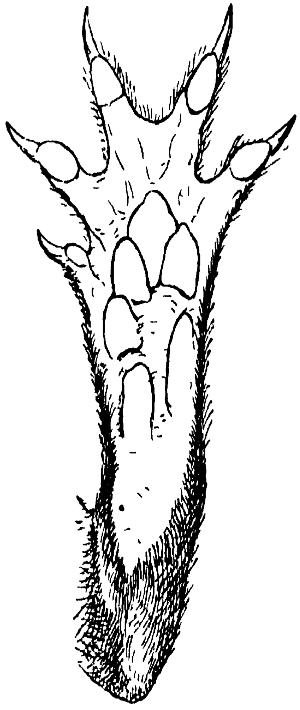

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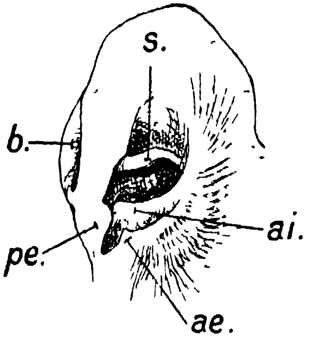


4

MUNGOTICTIS AND GALIDICTIS.

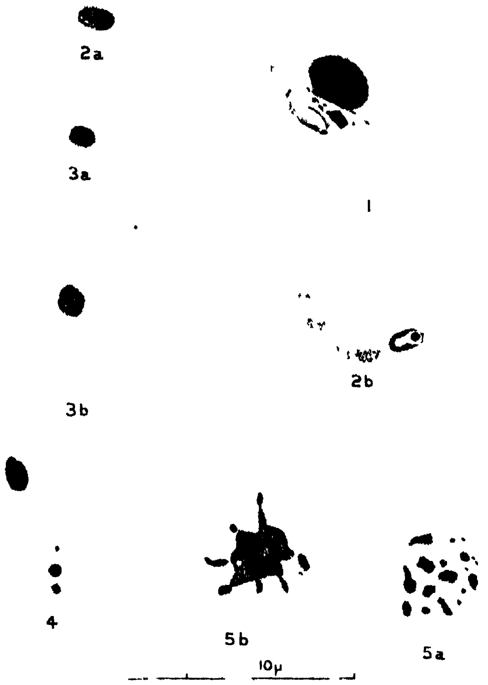


Fig. 1

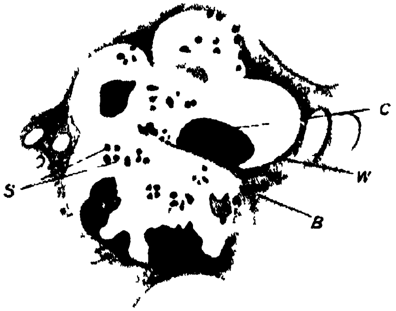


Fig. 2.

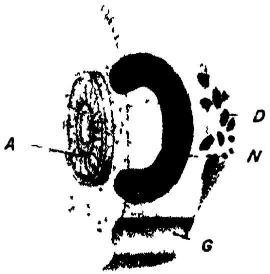


Fig. 3.

P. Gibson, del.

BENTHAM Ann. & Mag. Nat Hist S. 8. Vol. XVI. Pl XVII.

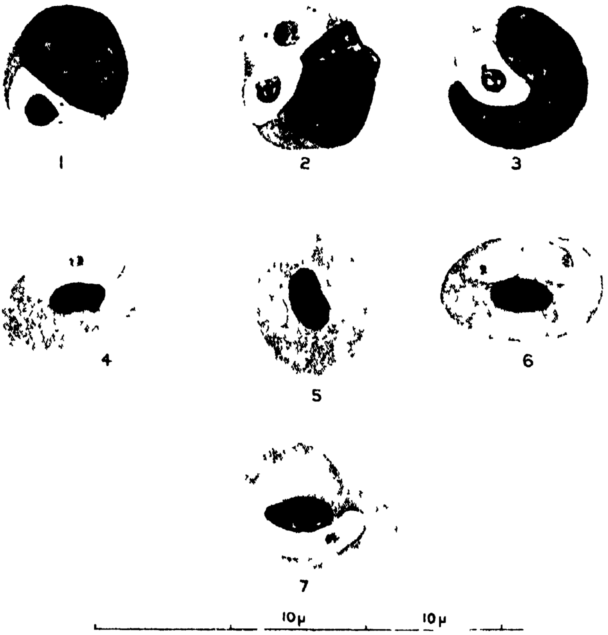


Fig 1

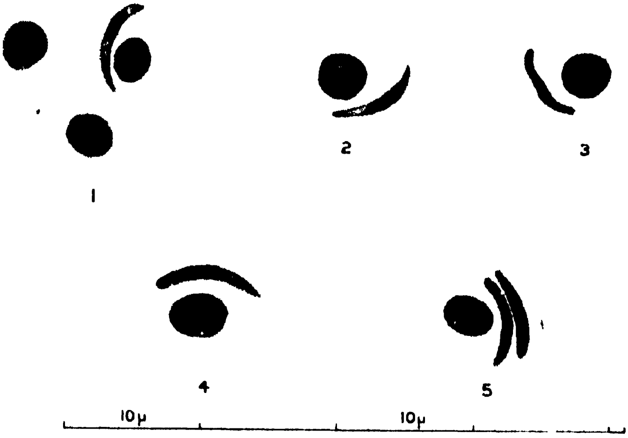
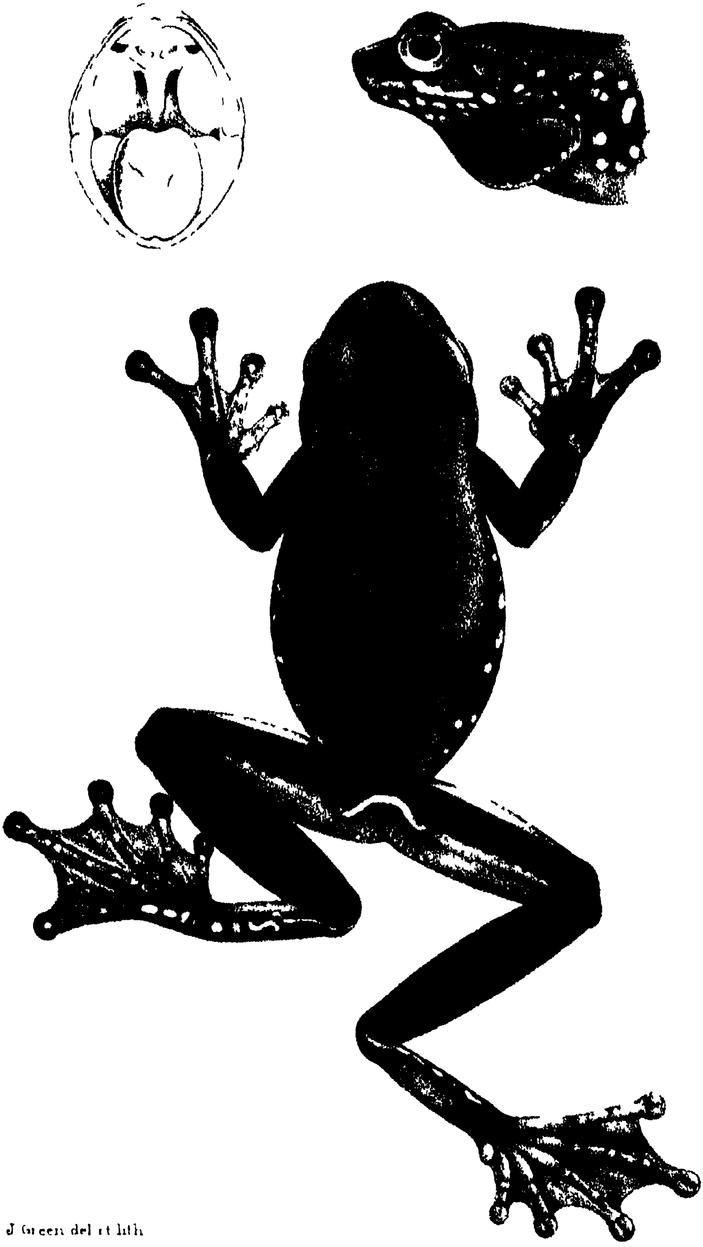


Fig. 2.

M. Bentham & P. Gibson, del.

BOULENGER. *Ann. & Mag. Nat Hist. S. 8. Vol XVI. Pl. XVIII.*



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